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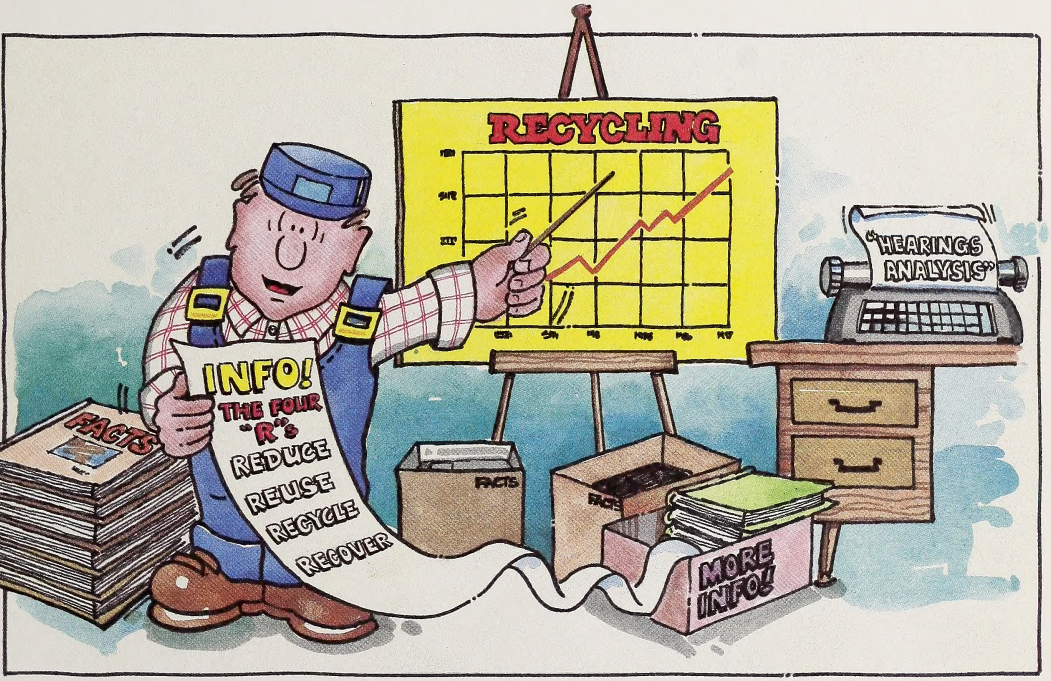
RECYCLING OF WASTE IN ALBERTA

Technical Report and Recommendations



Alberta
ENVIRONMENT COUNCIL OF ALBERTA

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RECYCLING OF WASTE IN ALBERTA

TECHNICAL REPORT AND RECOMMENDATIONS

March 1987

Environment Council of Alberta

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Lieutenant-Governor in Council
Legislative Building
EDMONTON, Alberta

Honourable K. Kowalski
Minister
Department of the Environment
132 Legislative Building
EDMONTON, Alberta
T5K 2B6

Dear Sirs:

I have the honour to transmit, herewith, the Report and Recommendations of the Environment Council of Alberta on Recycling of Waste in Alberta, as required under Section 7 (1) (i) of the Environment Council Act (Chapter E-13 R.S.A. 1980).

I have the honour to be, Sirs,

Your obedient servant,

Merrill K. Morstad
Chairman, Recycling Panel
Environment Council of Alberta

ACKNOWLEDGEMENTS

The help, co-operation, and enthusiasm that the Panel received from interested people at all levels was almost overwhelming. We hope this report reflects that spirit.

We can not begin to name everybody, but we will attempt to generalize. First of all, and without a doubt the most important, are those people who attended the public hearings and told us about their experiences and expressed their views. Waste recycling is not generally known to be high profile or highly profitable. The Panel felt that the majority of the people we talked to were people with commitment to a better environment, common sense, and the belief that it was better to use waste material than to pay to dispose of it. We learned a lot from many different industries and civic departments as they guided us through their plant operations. We would like to express our thanks to the companies and city departments listed below:

Alberta

Applied Polymer Research Ltd. (Edmonton plant)
Building Products of Canada (Edmonton plant)
Camrose Regional Waste Management Authority (landfill and transfer station)
City of Lethbridge Landfill
City of Medicine Hat Landfill
Contain-A-Way (Edmonton warehouse)
Cosmos Enterprises, Red Deer
Domglas, Redcliff
Edmonton Water and Sanitation Division (Strathcona Transfer Station,
    Cloverbar Landfill, curbside collection pilot project)
Hanna Transfer Station
Mannville Canada Inc., Innisfail
Redi Enterprises, Medicine Hat
Stelco (Edmonton plant)
Turbo Resources (Edmonton plant)
Wainwright Regional Incineration Authority (incinerator)

Ontario

Grow-Rich Organic Fertilizers, Niagara Falls
Halton Recycled Resources, Burlington
Laidlaw Waste Management Ltd., Mississauga
Metal Recovery Industries Inc., Hamilton
Niagara Recycling, Welland
Ontario Paper Company, Thorold
Ontario Resource Recovery Centre, Downsview

British Columbia

Belkin Paperboard, Burnaby
Mohawk Oil, North Vancouver
Northwest Rubber Mat, Pitt Meadows

All our public hearings were attended by Tom Rogers from the Alberta Department of the Environment and, in southern Alberta, by his assistant Dave Whitfield as well. They kept the meetings informed as to what is already being done on a local basis and where services were already available. Their complete co-operation and dedication was a great help.

We had meetings with 18 other provincial departments and three federal government departments. Their input and presentations were very enlightening.

Last, but not least, we wish to acknowledge and thank the staff of the Environment Council of Alberta. They paved the way for our Panel with much public relations including town hall meetings in all hearing locations prior to our meetings, to arouse interest and start the ball rolling. They made all the arrangements and did a lot of research. They recorded the proceedings so we could concentrate and communicate with the speakers. The recording was completed in such a way that it was very easy to refer back to later on.

In particular we would like to thank Dave Buchwald, John Lilley, Brian Free, Ken Nelson, and Elaine Kaiser of the Environment Council. Their dedication and co-operation was the very best.

From all the Panel,

Thank you.

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SUMMARY OF RECOMMENDATIONS

The following is a summary of the recommendations resulting from the Panel's enquiry. The recommendations are based on the information gathered during the enquiry and the knowledge and experience of the Panel members.

Page 25 **Recommendation 1**

The Government of Alberta should adopt, as a policy, the principle of "user pay" for municipal waste management systems.

Page 24 **Recommendation 2**

A comprehensive study should be undertaken by Alberta Environment and Alberta Municipal Affairs to determine the conditions for operating municipal waste management systems on a cost-recovery basis. The study should include an analysis of transferability of such approaches to other municipalities.

Page 23 **Recommendation 3**

Alberta Environment and Alberta Municipal Affairs should develop a methodology for the full assessment of landfilling costs, determine those costs for a variety of Alberta situations, and maintain an information base on true landfill costs for use by Alberta municipalities. It would be desirable to integrate the Alberta cost analysis with that being conducted by the federal Department of Energy, Mines and Resources, to avoid duplication and to integrate methodologies as much as possible.

Page 25 **Recommendation 4**

The Municipal Government Act should be amended to require that waste management be treated as a utility, and be self-supporting on the basis of revenue generated.

Page 26 **Recommendation 5**

Alberta Environment should phase out its capital assistance program for development of regional landfills and make the funds that are freed up available as incentives for recycling.

Page 27 **Recommendation 6**

Alberta Environment and Alberta Municipal Affairs should examine the practicality of different methods of "metering" waste collection and charging accordingly. Information obtained should be developed in a form that is readily accessible to municipalities to allow them to choose the metering approach that most adequately fits their situation.

Page 30 **Recommendation 7**

The Government of Alberta should adopt the "Four R's" – reduce, reuse, recycle, and recover – as its policy and priority sequence in waste management.

Page 88 **Recommendation 8**

The Minister of Environment should request the federal government to conduct a study of the impact of product design and packaging upon waste disposal costs and upon the environment. The objective is to establish a set of rules or guidelines for goods marketed in Canada which would

1) reduce waste generation
2) maximize reuse of resources
3) provide for recycling
4) facilitate resource and energy recovery.

Page 88 **Recommendation 9**

The Minister of Environment should request the federal Department of Consumer and Corporate Affairs and Environment Canada to examine the feasibility of a surcharge or checkoff at the manufacturer or import level that is related to the extra disposal costs generated by non-recyclable packaging, wrapping, and container materials and by products that are difficult to dispose of, such as rubber tires.

Page 39 **Recommendation 10**

Alberta Environment should develop an information package on backyard composting methods and the advantages of composting.

Page 39 **Recommendation 11**

Alberta Environment and the City of Edmonton should implement an experimental composting project in those areas of Edmonton currently served by the curbside recycling project.

Page 39 **Recommendation 12**

Alberta Environment should work with large producers of organic material, such as city parks departments, zoos, and racetracks, to encourage the establishment of composting areas at landfills or other suitable locations.

Page 79 **Recommendation 13**

Alberta Environment and Alberta Municipal Affairs should establish a system for advertising the locations of disposal sites that would be willing to accept construction and demolition rubble.

Page 70 **Recommendation 14**

The Beverage Container Act and its regulations should be amended to include all beverages sold in all types of sealed containers, except milk or milk products.

Page 72 **Recommendation 15**

A single minimum deposit level should be placed on all beverage containers, except those used for milk and milk products.

Page 72 **Recommendation 16**

A uniform minimum deposit of 10 cents should be set for all containers included under the Beverage Container Act.

Page 73 **Recommendation 17**

In order to increase the number of universal depots, Alberta Environment should relax the licensing policy concerning the number and locations of these depots.

Page 73 **Recommendation 18**

Alberta Environment guidelines for universal depot licences should include special consideration of proposals that include recycling of commodities not covered by the Beverage Container Act.

Page 74 **Recommendation 19**

Applications for the establishment of universal depots as sheltered workshops, or as part of a sheltered workshop, should be considered favorably by Alberta Environment and refused only under exceptional circumstances.

Page 74 **Recommendation 20**

A two-year freeze should be placed on handling charges to allow the universal depot operators time to adjust to changes to the Beverage Container Act. During this freeze, there should be a thorough examination of the system in order to determine appropriate handling charges.

Page 75 **Recommendation 21**

Alberta Environment, in conjunction with local government, should develop an effective information program to publicize the use of the Oil Drop Program and oil collection tank network.

Page 76 **Recommendation 22**

The Government of Alberta should recommend to Agriculture Canada that it ban all pesticide containers that are not safely and economically recyclable or reusable.

Page 76 **Recommendation 23**

Agriculture Canada should contribute funds to Alberta to cover the costs of its Pesticide Container Collection Program.

Page 59 **Recommendation 24**

The Alberta Environment Resource Recovery Grant Program should be continued with increased funding so that volunteer recycling efforts can be provided the essential boost that they often need in the form of capital equipment to get recycling projects started.

Page 65 **Recommendation 25**

Alberta Environment should expand the Resource Recovery Grant Program to include recycling businesses as well as non-profit recycling projects.

Page 43 **Recommendation 26**

Alberta Environment should modify current incineration guidelines to require incineration proposals to include consideration of energy recovery in the design, siting, and operation of the facility.

Page 15 **Recommendation 27**

Alberta Environment should ensure that sufficient research is done under Alberta conditions to establish the desirability of incinerating municipal solid waste from an environmental and economic perspective.

Page 16 **Recommendation 28**

Alberta Environment should revise current incinerator guidelines to incorporate new information or experience under Alberta conditions before any additional incinerators are permitted to burn municipal solid waste.

Page 15 **Recommendation 29**

Since proper operation of incinerators is just as essential as good design, the Province should develop, or adopt from other Canadian jurisdictions, training programs, certification standards, and testing practices that will help ensure adequate skills and operational proficiency for those who operate waste incinerators.

Page 42 **Recommendation 30**

The Public Utilities Board and Alberta Energy should conduct a review of utility rate structures with the intent of removing unnecessary barriers to the recovery and use of energy from waste.

Page 84 **Recommendation 31**

The Minister of Education should ensure that when the Alberta school curriculum is reviewed, waste management and recycling are included as an integral part of the curriculum — as part of the knowledge base expected of Alberta citizens.

Page 84 **Recommendation 32**

Alberta Environment in conjunction with Alberta Education should develop and circulate an information kit describing extra-curricular activities or projects that could be used in Alberta classrooms to encourage recycling habits.

Page 84 **Recommendation 33**

Alberta Education, the Alberta Teachers' Association, and the Alberta School Trustees' Association should ensure that the Four R's of waste management are included in teachers' in-service training.

Page 83 **Recommendation 34**

ACCESS Alberta should produce a series of audio-visual resource materials based upon the Four R's of waste management.

Page 85 **Recommendation 35**

Alberta Education should direct Alberta school boards to examine and improve the operation of the Alberta school system to better reflect the Four R's of waste management.

Page 85 **Recommendation 36**

Alberta Education should encourage schools to recycle paper and other recyclable materials that are currently being incinerated or otherwise disposed of.

Page 85 **Recommendation 37**

Alberta Education should provide Alberta school boards with information about the availability and cost of recycled paper and encourage the boards to take advantage of opportunities to purchase recycled paper.

Page 87 **Recommendation 38**

The Minister of Environment, through the Canadian Council of Resource and Environment Ministers, should encourage the federal government to develop and implement a public awareness program focusing on the Four R's of waste management: Reduce, Reuse, Recycle, and Recover.

Page 86 **Recommendation 39**

Alberta Consumer and Corporate Affairs should develop a consumer education program aimed at reducing the quantity of waste generated by consumer goods and services. This program should focus on reuse, recyclability, repairability, and durability of products, as well as product packaging.

Page 86 **Recommendation 40**

Alberta Environment should promote the development of a national recycling symbol. This symbol should be displayed with an appropriate message indicating whether the product is recyclable or contains recycled material.

Page 79 **Recommendation 41**

Alberta Environment should establish a toll-free telephone service for information about recycling in Alberta.

Page 80 **Recommendation 42**

Alberta Environment should evaluate the Recycling Computer Model and make modifications to improve its relevance for Alberta. The Department should then make this computer program available to municipalities for use as a planning tool for waste management services.

Page 90 **Recommendation 43**

The Alberta government, through the Minister of Environment, should urge the federal Minister of Environment to initiate action within the federal government to treat recyclable goods and materials and virgin materials in an equitable manner with respect to taxes, exemptions, and industrial development programs.

Page 90 **Recommendation 44**

The Alberta Minister of Environment should bring before his colleagues on the Canadian Council of Resource and Environment Ministers the recommendation that all capital expenditures associated with processing of recyclable materials be eligible for the Accelerated Capital Cost Allowance (ACCA) for pollution control equipment on the basis of the percentage of recyclable material used.

Page 91 **Recommendation 45**

The recycling industry should be considered a manufacturing industry and should be eligible for the full range of industrial development grants.

Page 109 **Recommendation 46**

Alberta Environment should investigate the merits of providing a one-time capital grant to assist any company willing to develop a modern used oil re-refinery in Alberta. The levels of assistance should be comparable to those provided for such projects as heavy oil upgraders, since the principle of equality between processing used and virgin materials should apply.

Page 55 **Recommendation 47**

If the City of Edmonton's curbside collection project continues to be successful, it should be continued as a regular service and gradually expanded to cover the entire city.

Page 55 **Recommendation 48**

The provincial government should pressure those municipalities that subsidize waste collection to provide equivalent subsidies for collection of recyclables.

Page 52 **Recommendation 49**

Alberta Environment, in co-operation with Alberta Municipal Affairs, should develop a municipal bylaw provision that would provide for adequate safe and convenient storage space for recyclable materials in new multi-family dwellings, office buildings, and shopping malls.

Page 30 **Recommendation 50**

The Alberta Research Council, in consultation with industry, should develop a "waste audit" program to assess waste management practices in appropriate industrial and commercial businesses and provide advice on ways to reduce waste generation.

Page 49 **Recommendation 51**

Alberta Community and Occupational Health and Alberta Environment should develop guidelines to facilitate and encourage salvaging of resources from municipal landfills.

Page 78 **Recommendation 52**

Alberta Environment and the Alberta Research Council should place a high priority on maintaining the Alberta Waste Materials Exchange and improving its effectiveness.

Page 78 **Recommendation 53**

Alberta Environment should approach the trucking industry in Alberta to establish an information system to facilitate the use of backhauls for moving recyclable materials.

Page 99 **Recommendation 54**

In order to facilitate the recycling of non-deposit glass, the Alberta Liquor Control Board and Alberta Environment should investigate the feasibility and desirability of Contain-A-Way purchasing bulk loads (one tonne or more) of non-deposit glass at its warehouses in Calgary and Edmonton.

Page 100 **Recommendation 55**

Alberta Environment should investigate the feasibility of including non-deposit glass from universal depots in the current system for collecting and transporting beverage containers.

Page 105 **Recommendation 56**

Alberta Environment should investigate ways for potential recyclers to have access to balers in local businesses, or liquor stores.

Page 104 **Recommendation 57**

The feasibility of using a mobile baler to increase recycling of old corrugated cardboard in rural areas should be investigated by Alberta Environment.

Page 105 **Recommendation 58**

Alberta Environment should issue a call for proposals to adapt agricultural balers for baling old corrugated cardboard.

Page 104 **Recommendation 59**

To show government support and leadership in recycling, Alberta Environment should consider its office paper recovery program an example for other office buildings, take steps to increase public awareness of the program, and encourage implementation by other major generators, beginning initially with provincial government departments and agencies.

Page 109 **Recommendation 60**

Alberta Environment should investigate methods for prohibiting the use of used oil in major road-oiling projects.

Page 116 **Recommendation 61**

Alberta Environment and Alberta Community and Occupational Health should encourage all municipalities to place discarded tires in designated areas of the landfill to facilitate future recovery and recycling.

Page 111 **Recommendation 62**

Alberta, through the Minister of the Environment, should encourage Environment Canada, in conjunction with the Society of the Plastics Industry of Canada, to establish a research institute with the objective of improving the recycling of post-consumer plastics in Canada. This research institute could be funded in part by funds collected by a checkoff on plastic products and in part by direct contributions from the plastics industry.

Page 106 **Recommendation 63**

A major market survey and feasibility study should be conducted by Alberta Economic Development and Trade to determine the markets for all grades of paper, and the feasibility of accessing domestic and foreign markets.

Page 103 **Recommendation 64**

Alberta Public Works, Supply and Services should investigate the feasibility of requesting suppliers of paper to the government to supply paper containing recycled fiber.

Page 99 **Recommendation 65**

Alberta Environment and Alberta Economic Development and Trade, in conjunction with the fiberglass industry, should undertake a study to determine the feasibility and economics of supplying cullet, especially green, for use by the fiberglass industry.

Page 108 **Recommendation 66**

Alberta Environment and Alberta Public Works, Supply and Services should work together with the used oil re-refiners to determine the market for recycled oil and to promote its use in federal, provincial, and municipal government vehicles.

Page 114 **Recommendation 67**

Alberta Environment and Alberta Economic Development and Trade should investigate the feasibility of further processing aluminum scrap within Alberta.

Page 92 **Recommendation 68**

Alberta, through the Minister of the Environment, should encourage the development of a Western Canadian Recycling Committee. The Committee's prime objective should be to promote co-operative recycling efforts across Western Canada.

Note: The recommendations are numbered to reflect their order of appearance in the companion summary to this report, entitled *Recycling of Waste in Alberta: Summary Report and Recommendations.*

The Council wishes respectfully to place these recommendations and this report before you.

Environment Council of Alberta
Panel on Recycling of Waste in Alberta

Merrill K. Morstad, Chairman

Alistair D. Crerar, Vice-Chairman

David Chan, Member

Bob Jones

Robert M. Jones, Member

Gordon Osgood, Member

I. INTRODUCTION

A. BACKGROUND

Alberta is still a land of open spaces, scenic beauty, and, for the most part, clean air and clean water. Albertans cherish and expect to have a high-quality environment. These expectations usually are fulfilled, in no small part due to the diligence of Albertans in protecting their environment while encouraging economic development that supports and enhances their lifestyles.

Alberta's diverse economic development has resulted in a variety of waste materials, waste management problems, and waste management systems. The wastes that must be dealt with include those from the entire range of industries as well as schools, hospitals, construction sites, office buildings, farms, and commercial enterprises, and the variety of materials that individuals discard as household garbage. Approximately 1.8 million tonnes of solid waste is generated annually in Alberta, averaging almost 800 kg per person per year (37, 114).

The volume of waste produced is increasing, and so are waste management costs. An estimate of $86 million has been made for total disposal costs in Alberta in 1984 (Lilley 1985a). The increase in cost is due to the ever-larger volume of waste being generated as well as higher operating and capital expenses for improved waste management.

Regulations governing sanitary landfills require wastes to be placed in trenches, compacted, and covered daily with earth. Regulations also require a means for accurately weighing incoming materials, protection of groundwater and surface water from pollution, special drainage if necessary, adequate distance from any structures, dust control, fencing, and windbreaks to prevent blowing wastes. Sanitary landfills and transfer stations are replacing scattered, open, and often smoldering dumps. Achieving these standards has resulted in higher direct costs, although they are still lower than costs in more highly developed centers such as the lower mainland of British Columbia and southern Ontario.

But, to many, landfilling represents a waste of potentially usable resources. Although landfilling may seem to be an inexpensive solution to waste management problems, it offers few benefits other than burying wastes out of sight and out of mind. Landfilling still entails a number of social and environmental liabilities. These liabilities may include odor, dust, noise, traffic, and litter during the operating life of the landfill. As well, there are post-closure concerns about long-term environmental and health effects of leachates and gases from landfills. In many ways landfilling is not a treatment system but more a means of storage.

There is no guarantee, with the modern mix of wastes going into landfills, that these wastes will be turned into innocuous material with the passage of time, be it 25, 50, or 100 years. We may be simply creating problems for future generations. For these reasons, alternative waste disposal options are being investigated. Incineration greatly reduces the volume of solid municipal waste that requires landfilling. Capital and operating costs are high, but are becoming more attractive as the cost of landfilling increases. In addition, there is the potential to recover energy in the form of steam or electricity.

Because recycling can provide a safe, certain solution for a substantial portion of the waste stream, it has become increasingly attractive as an alternative to conventional waste disposal methods. Individuals and entrepreneurs have always looked to wastes as a potential source of useful materials. This view of wastes was a necessity during the Depression when items had to be patched and repaired, used and reused until there was no possible further use for the material. Similarly, during the war years, waste was minimized and materials were salvaged to assist with the war effort. This "waste not, want not" ethic lives on in many people, but more recently other factors have contributed to the general public's interest in recycling.

Interest in recycling was evident in the early 1970s, a time when energy and commodity prices were increasing, environmental awareness was growing rapidly, and many environmentally oriented government programs were being put in place. This interest was associated primarily with "environmentalists" and was based on a philosophy of conservation of resources and environmental protection. Unfortunately, recycling projects based upon ethics and altruism seldom achieve their full potential. They need a sound economic base as well.

Many businesses have been engaged in recycling for years. Alberta examples include the use of waste paper in the production of building products, the re-refining of discarded lubricating oils, and the use of scrap metals as feedstocks for the steel-manufacturing industry. There already exists a sound, substantial, profit-producing, recycling industrial sector.

In 1971 the provincial government implemented the Beverage Container Act. This Act was aimed principally at reducing litter caused by beverage containers. Initially most of the material collected was landfilled. However, the availability of materials collected through the universal depots eventually stimulated recycling of scrap glass (cullet), aluminum, steel, and plastic beverage containers. An important impact of the Act was to encourage individuals to think about saving and returning materials that often were discarded.

It was hoped that depots would truly become "universal" in the range of materials that they would accept, although there was little action to encourage this. A few depots tried collecting newspaper, but low prices for paper made it an unprofitable commodity for depot operators and most collection efforts were left to volunteer organizations.

However, interest among individuals and within government continued. The Department of the Environment funded recycling studies in both Edmonton (Frost et al. 1974; Project Recycling Society 1974) and Calgary (Calgary Project Recycling Research 1971-72). Alberta Environment also reviewed alternatives to landfilling (Alberta Environment 1975). This latter report stated that although landfilling was the traditional and least costly disposal method:

> *In view of the increasing value of energy and raw materials, however, municipal solid waste should be considered as a valuable natural resource which has been converted to a less useful form...* (Alberta Environment 1975:i).

The report goes on to say:

> *The economics of establishing resource recovery centres would be more favorable if markets were readily available to absorb commodities from such centres. All levels of government could assist in this regard by creating a more favorable economic and social environment for recycling industries. Tax incentives and freight rate adjustments could be implemented to make recycled or reclaimed materials more competitive with raw materials* (Alberta Environment 1975:i).

The 1975 Alberta Environment report noted that the costs for energy and raw materials were increasing and the use of secondary materials as substitutes for virgin materials slowly was becoming economically viable. The use of cullet (scrap glass) increased and demand for recycled newspaper for use in cellufiber insulation grew. Interest in lubricating oil re-refining grew with increasing energy prices.

To support this growing interest in the recovery of recyclable material, Alberta Environment initiated two important programs: the Municipal Resource Recovery Program (1976) and the Oil Drop Program (late 1970s). The purpose of these programs was to encourage the establishment of collection systems for recyclable materials.

Two other government initiatives followed these recycling programs: the Pesticide Container Collection Program for the collection and proper disposal or recycling of pesticide containers, and the Alberta Waste Materials Exchange for facilitating the use of presently discarded industrial wastes.

As a result of this support, the public's interest has been heightened and recycling has grown. Significant amounts of glass, polyethylene terephthalate (PET) plastics, newspaper, cardboard, and oil are recycled. Markets have grown and diversified and now provide reasonable stability for those organizations and businesses interested in recycling. In recent years, because of heightened awareness of the hazards of landfilling industrial wastes and because of the difficulties that many areas have had with locating new landfill sites, methods to reduce dependence on landfilling, including recycling and incineration, have gained added prominence.

Although these alternatives may seem expensive relative to past practices, they can be less costly than unforeseen future liabilities. Examples of these alternatives are the hazardous waste disposal plant under construction near Swan Hills, and the trend toward better quality landfills. These changes are moves toward making the present generation of waste producers pay more of the cost of waste management, rather than transferring such higher costs to future generations. As more of the true cost of finally and safely disposing of waste is assumed, opportunities arise for material recovery through recycling.

The full potential of recycling in Alberta has not been achieved. Recycling can be expanded so that less material is wasted and more is recycled for the betterment of Alberta's economy and environment. How could this potential be achieved? This is the question the provincial government asked the Environment Council of Alberta when, in 1985, it requested the Council to conduct an enquiry and hold public hearings to find ways of encouraging the recycling of materials presently disposed of as waste.

B. THE PUBLIC HEARINGS ON RECYCLING

1. TERMS OF REFERENCE

Order in Council 106/85, February 20, 1985, gave the Environment Council of Alberta the terms of reference for the hearings. The Environment Council was requested to:

1) *Enquire into the potential for the economic recycling of products presently disposed of as wastes; giving particular attention to:*

   a) *the potential, scope and obstacles to increased recycling by private sector business enterprises;*

   b) *the potential, scope and obstacles to increased recycling by volunteer organizations;*

   c) *the support role of local governments and the provincial government in facilitating recycling by the private sector and volunteer organizations, considering the potential reduction in waste disposal costs, the enhancement of the environment and privatization.*

2) *Consider the potential and comparative economics of the generation of energy from wastes when the alternative of the creation of useful goods and services from wastes is not feasible.*

3) *Hold public hearings at suitable locations throughout the province, and report to the Minister of Environment and the Lieutenant-Governor in Council on completion of the report.*

The information upon which this enquiry and report are based consists of: background reports prepared for the public hearings, information obtained from the public hearings, discussions with provincial and federal government organizations, attendance and participation in conferences and tours, and the knowledge and experience of the Panel members.

2. THE HEARING PANEL

On April 3, 1986, a panel was appointed by Order in Council 244/86 to conduct the ECA's hearings.

The Panel consists of:

Merrill K. Morstad, Chairman. Mr. Morstad, a resident of Edmonton, held various positions with Renn Sales Edmonton Ltd. including President and General Manager, was Past President of the Alberta Farm Equipment Wholesale Association, and has been active in many community groups.

Alistair D. Crerar, Vice-Chairman. Mr. Crerar is Vice-Chairman of the Panel by virtue of his position as Chief Executive Officer of the Environment Council of Alberta. Mr. Crerar is an economist and planner.

David Chan, Member. Mr. Chan is an architect who graduated from McGill University, currently practicing in Calgary. He is active in charitable and volunteer community work, including the Calgary Chinatown Lions Club.

Robert M. Jones, Member. Mr. Jones is retired from farming and lives in the Warner area. He is involved with a number of local community activities, including the Warner Chamber of Commerce, the Elks Club, and the Border Counties Hospital Board.

Gordon Osgood, Member. Mr. Osgood worked for many years at Domglas in Redcliff. As well, he has been active in numerous service organizations, including the Redcliff School Board and the Redcliff Planning Commission.

3. INFORMATION PROGRAM

Prior to the hearings, the Environment Council made a substantial effort to contact people who might be interested in recycling. This included the general public, people involved with volunteer organizations and recycling projects, industries directly or indirectly affected by recycling or the recovery of energy from waste, generators of potentially recoverable waste, enterprises interested in the use of recovered materials, and government officials at all levels.

A mailing list of about 2,400 individuals and organizations was developed and these people received notification of reports, a newsletter that described the recycling hearing process and introduced the hearing Panel, and notices with dates for the ECA's information meetings and the hearings. Press releases were sent out to the Alberta news media as well as to appropriate periodicals and journals. Advertisements were placed in newspapers and with radio stations around the province.

Information meetings were held at the 11 locations at which the hearings were to be held. These meetings featured the video tape *One Man's Garbage, Another Man's Gold?* and a panel discussion about local recycling issues and present Alberta Government policies and programs, as well as information about the hearing process and the ECA's role and mandate.

Environment Council staff also met with regional planning commissions and people involved with recycling projects and spoke at various conferences and meetings. Once the hearing Panel was appointed, members of the Panel participated in press conferences and interviews, and also met with community organizations.

4. BACKGROUND REPORTS

In preparation for the hearings, Environment Council staff researched and wrote a series of background reports on recycling and energy from waste. These reports are described below and listed in Appendix 1. Copies of ECA reports may be obtained from the Environment Council Library.

Garbage to Gold? Issues and Opportunities

This report presents the terms of reference for the hearings, describes the hearing process, and provides a summary of the background reports, highlighting some of the issues relevant to the hearing and public consideration of the topic.

Municipal Solid Waste — Alberta's Untapped Resource?

About 1.8 million tonnes of municipal solid waste are discarded each year in Alberta. This report answers questions such as: What is the composition of this waste? How is it collected, transported, and disposed of? What waste treatment practices are available to handle this waste and what might be done in the future?

Resource Recycling in Alberta

This report discusses the amounts of metals, rubber, glass, lubricating oil, plastics, and paper used and recycled in Alberta and some of the opportunities and constraints that affect increased recycling of these materials.

A Social Perspective of Recycling in Alberta

In this report recycling is examined from a social perspective. What is the role of public attitudes and personal motivation? What are some of the social costs and benefits of recycling? The report also describes the involvement of individuals and groups in recycling activities.

Economic Barriers to Recycling

This report discusses some of the environmental advantages to recycling in the context of the flow of materials through the economy, and describes some basic economic obstacles to recycling and to increasing the supply of and demand for recycled products.

The Use of Municipal Waste as Fuel

This report, prepared in 1983, reviews literature related to the use of municipal waste as a fuel for power generation and discusses some of the options that involve separation and processing of usable elements in the waste. The report also describes some issues relevant to discussion of landfilling versus energy and resource recovery options.

Bibliography of Recycling

This is a bibliography of reference materials used in the preparation of the background reports. Sources and call numbers are provided where available.

Legislation, Policies, and Programs Affecting Recycling in Alberta

This report, prepared by and available from Alberta Environment, describes and discusses legislation, policies, and programs in Alberta that affect recycling. Included are reviews of the Beverage Container Act, the Oil Drop Program, Alberta Environment's Municipal Resource Recovery Program for assisting local recycling efforts, and the Alberta Waste Materials Exchange.

Video Tape

The Environment Council of Alberta, in co-operation with Alberta Environment, also had prepared a video tape called *One Man's Garbage, Another Man's Gold?* This 15-minute video tape was used during the information program to provide an overview of recycling in Alberta and discussion of some future options. It may be borrowed from the Environment Council Library.

5. THE HEARINGS

Public hearings were held at 11 locations across the province (Appendix 2). In total, 134 briefs were received, including 23 submissions received after the hearings. Thirty-five percent of attendees registered as private citizens, 23 percent were affiliated with some level of government, 17 percent with industry, 16 percent with an organization or educational institute, and 9 percent were in other categories.

Excellent submissions were received at all locations and the Panel expresses its sincere appreciation to those people who participated in the hearings or who took the time to write down their concerns and recommendations. All submissions showed a high level of interest and a personal commitment to the idea of recycling. The variety of views expressed was most appreciated and the effort that people made to attend the hearings or to share their ideas and concerns with the Panel was an inspiration to the Panel as it worked toward developing a comprehensive set of recommendations for the province.

6. POST-HEARING ACTIVITIES

The briefs submitted covered a wide range of ideas, interests, and concerns, reflecting the broad cross-section of society that participated in the hearings. In order to give proper consideration to the amount of information, the Environment Council developed a computerized information base. All briefs, the questioning of presenters, and the subsequent discussion period were carefully analyzed by ECA staff. All of the ideas, concerns, information, and recommendations were recorded for input into a computer. Each comment was coded to indicate its subject and the comments then were indexed according to the codes. In this way information on any subject discussed during the hearings could be readily accessed. In this report, information from the hearings is cited by the brief number (given in brackets). A list of presenters can be found in Appendix 3.

The result of this content analysis was a computerized information base containing approximately 2,800 pieces of information on all aspects of the recycling of wastes in Alberta. Verbatim transcripts were often referred to for more complete statements or to verify statements referenced in the report. These transcripts, on computer discs or as paper copy, are available in the Environment Council Library.

After the hearings, the Panel met with 22 government departments and agencies and three non-government organizations whose policies and programs could affect recycling in Alberta. (For a complete listing see Appendix 4.) The Panel also visited many recycling projects and industries in Alberta. In addition, members of the Panel attended conferences, met with government officials, and visited recycling operations in Ontario, British Columbia, and Washington State.

7. SOME GENERAL IMPRESSIONS

As indicated by the presentations, many Albertans are concerned about the present management of wastes in this province, specifically about the use of landfills as the primary method of disposing of wastes. Many briefs made the point that the costs associated with landfilling are not accurately measured. The economic costs do not reflect the true social, environmental, and replacement cost of landfills. These presenters suggested that, if all costs were included, the true value of recycling would be evident and recycling would increase.

A large number of briefs also expressed a basic philosophical objection to burying materials that are potentially reusable. Recycling was seen as a means of saving resources, including energy, and of lessening the environmental impact of resource extraction, including air, water, and health impacts. By general consensus, recycling is an appropriate waste management technique and should be encouraged. However, many presenters also stated that there was a significant lack of educational material about recycling. They pointed out that information was needed on the benefits of recycling, as well as "how to" handbooks and booklets.

There was one notable overall impression: no one, in any capacity, was against recycling. There were those who felt that others (not themselves) were not sufficiently motivated to take the extra effort that recycling required. There were many who felt that low population density and high transportation costs made the economic viability of additional recycling doubtful in Alberta. But even the skeptics wanted recycling to succeed and had helpful suggestions to overcome the barriers.

Albertans we heard from at the hearings were proud of their province and valued its cleanliness. They saw the recycling we have done so far as contributing to the tidiness and cleanliness of the province and they heartily approved of the results. It is the Panel's overall impression that there is substantial support for recycling and its perceived beneficial results. It is on this solid base of support that the Panel has constructed its recommendations for recycling.

II. MANAGING WASTE IN ALBERTA

"Waste", commonly known as garbage, is any substance for which the owner or generator has no further use. It is therefore a subjective term. During this enquiry into recycling, the Panel learned that some of the waste discarded by one segment of society was considered a useful resource by others. In order to better understand this potential for recycling, our investigation begins with a look at what our waste consists of and how it is currently managed in Alberta.

A. THE RESOURCE

Solid waste is generated during manufacturing and consumption of materials and goods in our society. There are two options for dealing with this waste material: recycle it into the manufacturing/consumption cycle or dispose of it in a landfill (Figure 1), with or without some form of pre-treatment such as incineration or shredding.

FIGURE 1

Options for Dealing with Wastes Generated by Production, Marketing, and Use of Commodities

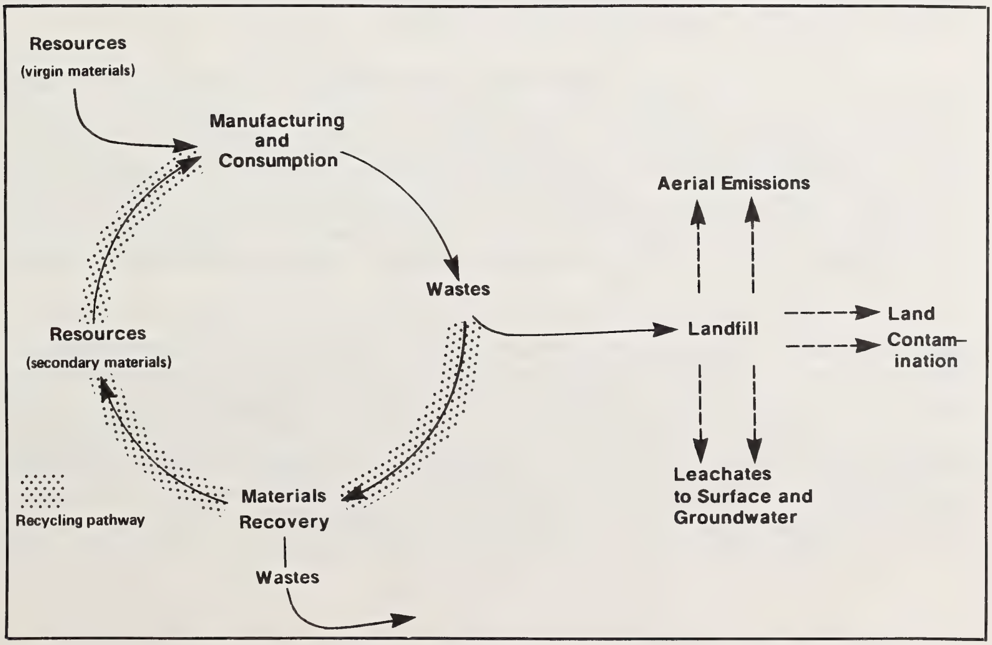
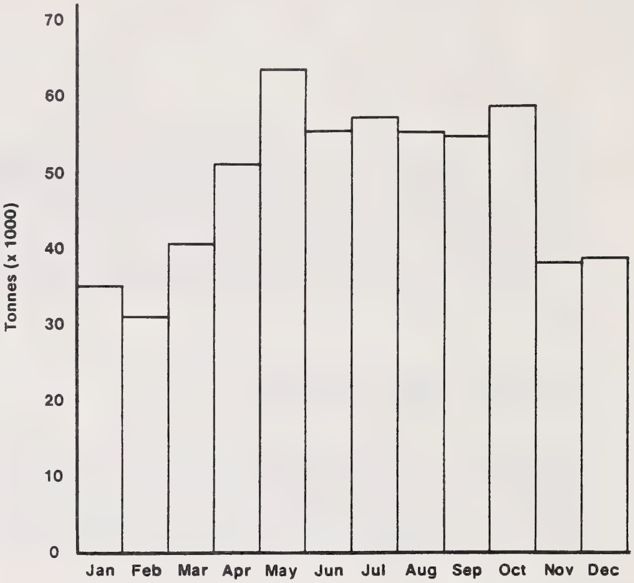


FIGURE 2

Solid Waste Landfilled at Edmonton Cloverbar, 1985



Source: City of Edmonton, 1985

Information about the nature of Alberta's solid waste stream was collected prior to the hearings and published in the report *Municipal Solid Waste – Alberta's Untapped Resource?* (Free 1985). Additional information was provided at the hearings and subsequent consultations. For major cities like Edmonton and Calgary, between 850 and 950 kg of waste are produced per capita per year. In rural areas, waste generation rates are substantially lower, about 600 kg per capita per year (Free 1985). These generation rates are comparable to other jurisdictions.

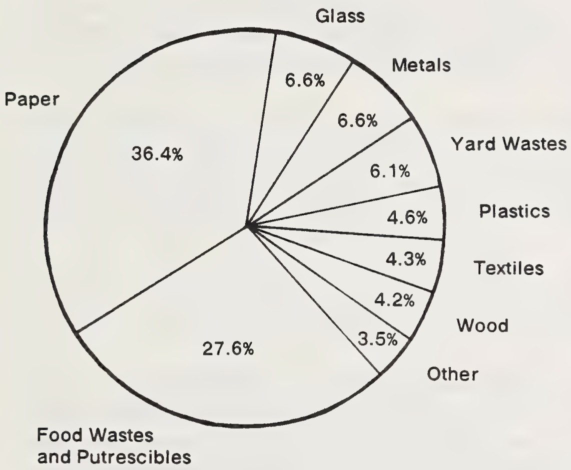
There is considerable seasonal variation in the amount and kind of waste produced. Yard waste, such as grass clippings and tree prunings, contributes large quantities of organic material during the spring and summer months. There is also generally more activity and waste generation in summer than in winter. The combination of factors results in high generation rates in late spring and summer and a low in winter (Figure 2).

The composition of our waste stream will vary as communities change, new industries develop, and consumer preferences evolve. Free (1985) describes the present composition of Alberta's municipal solid waste. Paper products form a large portion of the waste stream, ranging from about 30 to 50 percent. Another major component is food scraps and other putrescible wastes, which contribute up to one-third of the waste stream (55, 70, 123). Glass, metal, and plastics make up a small fraction, with each contributing about 5 percent to this solid waste stream. The remainder consists of textiles, wood, rubber, and other miscellaneous materials (Figure 3).

Figure 3 portrays a typical community waste stream. This material comes from residential, commercial, and industrial sources, each category generating 20 to 40 percent of the solid waste. The exact contribution varies from community to community and year to year. In small communities, large local industries and commercial establishments often produce a significant portion of the community's refuse and have a major influence on the waste stream. Studies of individual communities would be necessary to determine exact waste stream characteristics.

FIGURE 3

Composition of Municipal Solid Waste in Canada



Source: Bird and Hale Ltd. et al. 1979

Although it often was not included in descriptions of waste streams, construction and demolition rubble is commonly disposed of in landfills. Large quantities of this rather innocuous material occupy considerable space in landfills. In 1981, 49.6 percent of the material deposited in Edmonton's landfills was construction and demolition rubble (City of Edmonton, Water and Sanitation Division, unpublished data) but by 1985, the rubble component had dropped to 21.9 percent (City of Edmonton 1985). Thus, the impact of construction and demolition activity on landfill capacity is significant but variable.

B. WASTE MANAGEMENT SYSTEMS

Most of Alberta's municipal solid waste is handled through community waste management systems. Waste is collected by municipal or commercial agents and disposal is at a common landfill site. Some waste does not enter this community system, but is disposed of on the generator's property. Invariably, a certain amount of refuse is improperly disposed of and ends up littering our landscape.

1. COMMUNITY WASTE MANAGEMENT SERVICES

The Municipal Government Act gives municipalities responsibility for properly disposing of solid waste generated within the jurisdiction. This delegation of authority has led to collection and disposal services provided by either municipal workers or private companies under contract to the municipality. Single-family dwellings usually have weekly curbside collection; multi-family residences often require bulk container service with more frequent pickup.

The choice between public and private collection services varies from community to community. The decision is based on community tradition, economics, politics, and other factors. Edmonton, Calgary, Lethbridge, and Medicine Hat use municipal workers and private contractors to collect residential refuse; Red Deer, Lloydminister, and Grande Prairie rely on private haulers (Free 1985). In small communities and rural areas, the local tax base may not support a municipal work force, collection vehicles, and administration for waste management. A private company may be hired to provide the entire service. Commercial and industrial solid waste is often collected by private haulers under arrangements with each generator, although some commercial wastes may be collected by city employees.

Many Alberta municipalities are combining their resources to develop regional waste management systems (49, 50, 67). The provincial government has encouraged the development of these regional sanitary landfills to replace local dumps, which have a history of poor design and operation. Two or more municipalities plus the surrounding rural area can form a Regional Waste Management Authority to develop and operate a regional waste management system. This system usually consists of a regional sanitary landfill served by several local transfer stations. Refuse is collected and taken to the nearest transfer station, from which large transport trucks haul it to the regional landfill for disposal.

Through the Regional Waste Management Assistance Program, Alberta Environment provides funds for capital expenditures for land acquisition, initial capital improvements, and major operating equipment (Alberta Environment 1985). Up to the end of 1984, the provincial government had provided over $14.5 million to 19 regional authorities or systems (J. Slupsky 1986; pers. comm.).

2. SELF-MANAGED WASTE DISPOSAL

Disposal of waste on private property is an accepted part of the rural Alberta lifestyle. Combustibles are often burned in a backyard barrel and non-combustibles are dumped in a garbage pit in an unused corner of the property (72, 88). Although this process is largely unregulated by government, some restrictions do apply. For example, disposal of waste material must not create a nuisance as defined in the Public Health Act. The property owner must ensure that no odors or wind-blown litter annoy his neighbors. Local bylaws may require that the appearance of the property meet certain standards, and thereby restrict the location of auto hulks or junk heaps. Potential contamination of surface water or groundwater is subject to action by the provincial government. Thus, although the disposal of personal waste on private property is largely unregulated, it does have to conform to society's standards of health and safety.

Private industries may also dispose of some wastes on their own property. Provisions for on-site disposal of solid waste can be included in the operating licence issued by Alberta Environment under the Clean Water Act. Furthermore, burnable debris such as wood chips and grass clippings can be burned on industrial sites. Remote industrial sites are more likely to have on-site disposal because collective waste management services are impractical or unavailable. In urban areas, the high value of industrial land for other uses, the difficulty of meeting pollution control standards, and the convenience of commercial waste collection services make removal of the waste from the site more attractive.

C. TRENDS IN WASTE MANAGEMENT

Accepted practices for managing solid waste are changing rapidly. The general public is better educated about the hazards of improper waste disposal and is demanding higher standards of waste management. It is becoming very difficult to site new landfills because of social, economic, and environmental reasons. Costs associated with waste management have risen substantially, forcing greater efficiencies and reevaluation of current practices. A number of trends in solid waste management have begun to emerge as a result of these social and economic pressures.

1. WASTE COLLECTION

Waste collection consumes a large portion of waste management budgets and considerable attention has been given to improving collection efficiency to reduce this cost. A major focus has been on reducing labor requirements. Labor costs have been reduced by decreasing the size of collection crews. In Edmonton, for example, collection crews were downsized from three to one-person crews between 1971 and 1976 (City of Edmonton 1985). It appears that one-person crews are becoming the norm for waste collection.

Advanced technologies are also being applied in this field. Computers are now frequently used to design efficient collection routes. Collection vehicles are better designed for ease of loading and increased capacity. The front-end loader truck that empties large metal waste bins is a familiar sight in commercial and industrial areas. Mechanized container handling is now being tested in residential areas as well. The City of Lethbridge has introduced an automated collection vehicle with a mechanical arm for picking up special waste containers. This has proven successful for commercial, industrial, and multi-family residential collection, but has had limited success for single-family residences (31).

There is a growing use of private companies that specialize in waste collection. The complexion of this industry has changed rapidly in recent times. The business of waste management has become more sophisticated, with large national and international corporations competing intensively for municipal contracts. By adding residential collection to their commercial accounts, private haulers can increase their route density and therefore their profitability. Several of these large corporations operate in Alberta. Many smaller, local companies are also involved in waste collection. Competition among these companies tends to lower the cost of private sector waste management services. Bott (1985) reports that private haulers can provide waste collection services for two-thirds the cost of municipal forces and still maintain a profit. He attributes the cost savings to better equipment, computerized routing, good maintenance, bulk purchasing power, and smaller, non-union collection crews (Bott 1985). The emphasis on worker performance in the private sector is an effective motivator.

In 1982, Edmonton City Council directed that the volume of residential collection contracted to the private sector be increased gradually from 25 percent to 40 percent (City of Edmonton 1985). However, this trend toward privatization probably will not sweep the entire municipal collection service in Alberta. There are certain advantages to maintaining a municipal-run service. It gives the municipality better control and more flexibility to adjust the collection service. There is also pressure from city employee unions to maintain this municipal work force. Municipal sanitation departments are responding to the challenge from the private sector by improving their own efficiency through computerized routing, more sophisticated collection vehicles, smaller collection crews, and so on.

The Panel states no preference for one or the other of private and public waste management services. The choice should be made by the local community based on its own circumstances. The recommendations of the Panel are neutral in this respect and can be implemented by either a private or a public work force.

Another trend in waste collection is the introduction of curbside collection of recyclable materials. In many communities across Canada and the United States, curbside collection of bottles, cans, newspapers, and other materials has become a service that is greatly appreciated by residents. Curbside collection of recyclables is very similar to general refuse collection and, for practical reasons, this type of service is often offered in conjunction with waste collection. Curbside collection of recyclables is discussed in more detail in Chapter V.

2. TRANSFER STATIONS

The transportation of refuse from the point of collection to the disposal site is also becoming more elaborate. As collection vehicles become more specialized, it is more efficient to dedicate them to collection and minimize the time and distance travelled to get rid of each load. Transfer stations are becoming a common intermediate step between collection and disposal. Collection vehicles deliver their loads to the nearest transfer station, where the refuse is transferred to long-haul trailers that transport large volumes of refuse to the disposal site. During this transfer, there is an opportunity to process the waste. Refuse is shredded at Edmonton's Strathcona Transfer Station and used as insulating cover at the Cloverbar landfill site. There is also the opportunity to segregate recyclables at transfer stations. Some regional transfer stations have been designed to accommodate recycling (49, 67). In Hanna, space at the transfer station has been made available to the Hanna (Young) Lions Club to accommodate their recycling activities. Edmonton's Kennedale Transfer Station is being used to store recyclables from an experimental curbside collection program.

3. LANDFILLING

The technology of landfilling has also been improved, primarily as a result of government regulation. Concern about the environmental hazards of waste disposal has led to more stringent design and operational requirements for landfills. More effort is made to contain, collect, and/or treat leachates and gases emanating from landfill sites. These measures have reduced the potential for environmental damage from landfills, but also have increased the cost of this disposal method. Another pressure on landfill costs is the escalating price of land: new land for landfill sites may cost three times as much as land purchased for the landfills currently in use (90).

In addition to the problem of higher costs, it is becoming more and more difficult to find acceptable sites for new landfills. In most localities visited by the Panel during the public hearings, finding acceptable landfill sites was considered very difficult (19, 32, 49, 59, 72, 91, 110, 111). The so-called NIMBY (Not In My Back Yard) syndrome is a major obstacle to landfill siting. This trend is repeated in other parts of the country as well. There are concerns about groundwater pollution, odors and gases, burning refuse, proliferation of vermin, increased truck traffic, littering, and consequent decreased land values (16, 19, 26, 36, 45, 51, 56, 58, 71, 72, 76, 78, 90, 126). People do not want landfills in their neighborhoods and past practices at unmanaged dumps make it difficult to convince them that carefully designed and supervised sanitary landfills will be less objectionable (106, 111).

4. INCINERATION

As landfilling costs increase and public acceptance of new landfill sites becomes more difficult to obtain, alternative waste management methods attract greater attention. Incineration of municipal solid waste greatly reduces the volume of material destined for landfill sites. This technology has been associated with waste management for many years in Europe and is gaining prominence in the United States and Canada. With assistance from the provincial government, the Wainwright Regional Incineration Authority has constructed an incinerator to reduce the volume of material destined for their regional landfill. This is a pilot project to evaluate the application of this technology in Alberta.

At the hearings, several people expressed interest in incineration as a waste management tool (4, 45, 47, 102). Some people, however, indicated that incineration was not a satisfactory solution to our waste management problems (76, 83, 132). The primary concerns about incineration are cost and air pollution. Incinerators constitute a large capital investment (62, 102) that may overwhelm the budgets of municipalities currently operating simple landfill disposal systems (4). A number of studies have pointed to municipal waste incinerators as possible sources of toxic air pollutants, most notably dioxins (Kidd 1984). This concern appears to be growing as more municipal waste incinerators are planned throughout Canada. However, some of these concerns are based on memories of inefficient old-style incinerators that produced air pollution. Modern incinerator technology is much improved in these respects. It was explained to the Panel that a well-designed incinerator should produce no harmful emissions (62, 76); however, problems may arise if even a well-designed incinerator is not properly operated (62, 84, 102).

Recommendation:

> **Alberta Environment should ensure that sufficient research is done under Alberta conditions to establish the desirability of incinerating municipal solid waste from an environmental and economic perspective.**

Alberta Environment does have environmental guidelines for incineration in place (Alberta Environment n.d.); these guidelines should be reviewed in light of results from the National Incinerator Testing and Evaluation Program (NITEP), other research, and experience with the Wainwright incinerator. The guidelines should address the design and operation of incinerators and establish training requirements for the operator. Public acceptance of this technology will be crucial for future development of incineration in Alberta.

Recommendation:

> **Since proper operation of incinerators is just as essential as good design, the Province should develop, or adopt from other Canadian jurisdictions, training programs, certification standards, and testing practices that will help ensure adequate skills and operational proficiency for those who operate waste incinerators.**

The federal Department of Environment is currently conducting the National Incinerator Testing and Evaluation Program to evaluate municipal waste incineration in Canada (Hay 1984). Three incinerator designs, including a two-stage combustion design similar to the one installed in Wainwright, Alberta, will be evaluated with respect to thermal efficiency and emissions output. The Wainwright incinerator will provide an excellent opportunity to evaluate this technology under Alberta conditions. As well, the Alberta Environmental Centre in Vegreville has recently installed a test incinerator to investigate the combustion of different fuels, including waste materials. The Panel encourages the provincial government to take advantage of these research opportunities to ensure that appropriate decisions are made about municipal solid waste incineration.

Recommendation:

> **Alberta Environment should revise current incinerator guidelines to incorporate new information or experience under Alberta conditions before any additional incinerators are permitted to burn municipal solid waste.**

D. RETHINKING WASTE MANAGEMENT IN ALBERTA

Alberta has a solid waste problem, a situation which is not unique to Alberta; it is faced by most jurisdictions. The problem is that we produce more waste than we need to and this places an unnecessary burden on taxpayers and the natural environment. The Panel concludes that a primary objective in searching for a solution to the problem should be to reduce the amount of waste we produce. This can be accomplished in part by each of us paying more attention to the amount of waste we personally generate. We can also divert material from the waste stream by reusing and recycling goods and materials. Material recovery is a major focus of the Panel's enquiry. A long-term objective should be to consider all wastes capable of some form of reuse or recycling, and to consider the amount of waste to be disposed of a measure of inefficiency. Information on the breakdown of a typical Canadian municipal solid waste stream provides a starting point (see Figure 3).

Even today we have the technical ability to recycle most household and commercial wastes. There is a commercially viable recycling industry and recovery rates are high for many discarded resources such as precious and ferrous metals. Other materials, of lesser value, have lower recovery rates. This is the case with paper, which presently has a recovery rate of around 25 percent. For some wastes the recycling techniques are known, but the the value of product compared to the cost of processing does not appear to be attractive. An example is the production of rubber crumb from steel-belted radial tires.

A small percentage of the municipal waste stream cannot be recycled using existing technology. This is true for items made up of a variety of materials, like tetrapak juice cartons* and many plastics. With plastics the major problem is identifying and segregating the many types of plastic resin.

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* Juice containers made of composite materials are a recent invention. These containers, referred to as "tetrapak" or "combibloc" cartons, have a layered construction of several materials including cardboard, aluminum foil, and plastic.

The major constraint to recycling more of the municipal waste stream is the difficulty of separating materials so that they are clean and homogeneous. A large reduction in the amount of material going to landfill could be achieved if adequate separation procedures could be developed, and if markets were available for the recyclable products. Since Alberta is only a small supplier of recyclable products to world markets, there are considerable opportunities for market expansion. The critical question is whether the returns from sales to these markets are sufficient to cover the costs of processing and transporting recyclable waste.

The objective of recycling or reusing most wastes is a long-range goal. However, we must begin working now toward such a goal by improving our present performance. In the meantime, we must dispose of residual wastes in an environmentally sound and socially acceptable manner. The legacy of improper waste disposal is a heavy one... one that should not be left for future generations.

1. SOCIAL CONSIDERATIONS

Attitudes play a major role in determining how solid waste is managed. Many actors are involved in waste management: waste generators, politicians, civil servants, private companies, and the general public. Everyone is a waste generator and all of us pay directly or indirectly for waste management services.

The Panel heard a number of people complain that Albertans produce too much waste and are thoughtless in the use of valuable resources (61, 88, 97, 116, 118). Many attribute the overload to our society's current desire for disposable products and the use of excessive packaging (20, 25, 55, 63, 83). The suggestion was made that Albertans should assume a greater responsibility for waste (63, 88, 119). Comments about a "throw-away" society, and a plea to reject excessive packaging or to repair and reuse rather than buy new, indicate a dissatisfaction with present attitudes (25, 61, 81, 100, 110). Attitudes are changing, however, and according to some presenters the conservation ethic appears to be growing and there is a desire to reduce waste (26, 33, 34, 44, 65, 71, 111, 116) and strong support for recycling approaches (26, 33, 34, 44, 45, 48, 51, 56, 60, 70, 97, 101, 111, 119, 127).

Our attitude toward waste is reflected in how waste is managed. Taxpayers insist that municipal waste management services must be provided at least cost (90). Solid waste management is therefore limited to the basics of collection and disposal. Broader considerations relating to the wise use of material resources are considered beyond the jurisdiction of local governments. However, positive changes in attitudes, habits, and lifestyles, which will be required to change waste generation rates, should be everyone's responsibility.

Positive changes in our attitudes toward solid waste will help to reduce waste. These changes start with greater personal responsibility for the waste generated. Although there appears to be some aversion to wastefulness, there are few pressures to encourage individuals to produce less waste. Waste is put into a bag or can at the far reaches of our property and is collected later by someone else. Once out of sight, it is also out of mind. Waste collection and disposal is considered to be an annoying but necessary cost... something which deserves the least possible thought or expenditure. However, to deny the existence of a waste problem, or to pretend that waste disposal is not a costly service, gives waste disposal the appearance of a non-problem, one that is ignored until a crisis arises, usually at the time a new disposal site must be provided.

2. WASTE MANAGEMENT COSTS

Provincial legislation identifies waste management as a municipal responsibility (59), although significant funding is provided by the provincial government. A consistent theme in municipal presentations at the hearings was considerable sympathy for recycling approaches (10, 19, 26, 31, 32, 49, 72, 105), but a concern that recycling would be more costly than present landfill practices (90). The low cost of operating a landfill was presented to the Panel as a compelling reason to reject alternative disposal methods (10, 90). The Panel is not convinced by this argument, and others pointed out that present landfilling costs are underestimated (45, 71, 76, 78, 86, 92, 96, 111).

It is inappropriate to compare the costs of alternative waste management options such as incineration, composting, or recycling with present landfilling costs. The comparisons are between different end results. Landfilling does not treat wastes, it stores them. It may be, after an unknown number of years, that the contents of current landfills will become harmless and the site suitable for reuse for a wide variety of objectives in perfect safety. But we do not know exactly when, if ever, this will occur. Landfill sites of 50 years ago may be perfectly safe to reuse now. However, they were filled with relatively simple materials. Today's landfills contain the complex residue of contemporary society: plastics, chemicals, and composite materials whose breakdown to harmless materials in a sanitary landfill is a matter of hope, not certainty, and there are current concerns about emissions to air, land, and water (10, 16, 26, 36, 45, 56, 58, 76, 78, 84, 94).

If material is composted, incinerated, or recycled, it goes through a known procedure that produces a much smaller residue of measurable quality. The clinkers and ash from incineration will be 10 to 20 percent of the waste burned, but may be high in heavy metal fractions. Such residues will require landfilling, but their volume will be much reduced. Other alternatives such as recycling and composting essentially create new materials from waste, with greatly reduced residue. With a sanitary landfill, the result is waste storage for an indefinite time, the creation of liquid and gaseous emissions (leachate and methane) of unknown quality, quantity, and time span, and a final product whose composition is problematic and whose reusability is uncertain.

The future cost of landfill space is also neglected in cost comparisons of landfill and alternative waste management options (92). The purchase of land for landfilling represents a large capital expenditure. The market price of land has increased substantially over the years and can be expected to continue to do so. In some cases, the municipality already owns land that is suitable for landfilling and can defer this cost for a time. In reality, this ignores the opportunity costs — the return the municipality could have achieved if that land had been sold or used for its highest and best use. Eventually new land will have to be purchased. Increased land costs can be delayed, but not avoided.

An alternative for a municipality is to pay for access to a privately owned landfill site. Some of Edmonton's solid waste is disposed of in a private landfill (90, 104) and Lethbridge is now served exclusively by a private landfill site (31). However, as the price of land increases, access to private sites will become more expensive as well. Whether public or private, landfilling is an unproductive land use and restricts the options for future use after the landfill operation has ceased and the site has been reclaimed. Landfills have traditionally been reclaimed to "green space," such as parks and golf courses, or other undemanding land uses such as parking lots and storage areas. Construction of buildings on former landfill sites is complicated by problems of subsidence, gases, and leachates. As our land becomes a more valuable resource, it is prudent to minimize the amount of land dedicated to landfilling.

Other costs associated with landfills are also rising. It is clear that landfill sites are becoming increasingly difficult to locate, due to local opposition (19, 32, 45, 70, 76, 88, 91, 114). New landfills, when finally established, tend to be further away than the facility they replace, with consequently higher transportation costs (26, 31). Potential sites must be thoroughly investigated to establish environmental suitability. In Ontario, every new landfill is subject to an environmental impact assessment (EIA). Although EIAs are not required for landfills in Alberta, landfill siting and design must meet environmental guidelines. Design and engineering costs have increased as greater monitoring and control of leachates and gases is required. Reclamation of landfill sites is more demanding and monitoring may extend far into the future. These costs are essential to the safe operation of a landfill and should be included in the overall cost calculations for landfilling.

In the future, one of the ways in which new landfill sites may become more acceptable to potential neighbors is by full compensation for loss of property value due to the presence of the landfill, as well as the procurement by the landfill authority of liability insurance that would provide to neighboring properties protection from most types of injury. Claims for negligence and nuisance are being treated with increasing sympathy by the courts and the levels of awards to complainants are rising. Liability insurance should be included as a cost of operating landfills.

Financing Waste Management

At present, waste management services are financed through provincial grants to municipalities, through municipal property taxes, through user charges or "tipping fees," and through the sale of recyclable materials collected at landfills.

Many Alberta municipalities charge householders separately for waste collection and include this on a monthly utility bill. However, in Edmonton and Calgary, collection services are paid for primarily from residential and commercial property taxes. In Edmonton, it is estimated that 89 percent of the cost of waste management is financed through property taxes (90). Examples of collection charges are given in Table 1.

Differences in accounting practices and in collection services make direct comparisons of collection charges difficult; however, Table 1 does provide an indication of present collection expenses. Commercial and industrial customers are usually charged at different rates than householders in single-family dwellings. These rates depend upon the level of service provided, such as frequency of collection or volume of refuse. If collection is not provided by the municipality, customers need to contract with the private sector for collection services.

Table 1. Residential Waste Collection Charges

	Monthly Rate per Dwelling	Primary Source of Funding
Edmonton	$ 3.57	taxes
Calgary	$ 4.17	taxes
Red Deer	$ 3.83	direct charge
Lethbridge	$ 7.75	direct charge
Medicine Hat	$ 5.75	direct charge
Lloydminster	$ 2.50	direct charge

Source: City sanitation departments, except for Lloydminster data, which is from Brief 75.

Information presented at the hearings suggests that waste collection comprises the largest portion of a large municipality's waste management budget. For example, in Edmonton about $7 million to $8 million is spent on residential garbage collection compared to about $1.5 million on landfill operations (90). This works out to about $45 per tonne of refuse collected and $3.81 per tonne landfilled (90). The high cost of collection is primarily due to equipment and labor costs. The Panel's expectation is that landfilling costs will become much more significant when new sites have to be acquired and when full and accurate landfilling cost data become available. Current costs in more highly developed areas of Canada, such as the lower mainland of British Columbia and southern Ontario, are a guide to cost levels that Alberta will experience in the future.

There is aggregate information on waste management costs for all Alberta municipalities, prepared by the Department of Municipal Affairs. It shows the following:

Table 2. 1985 Garbage Collection and Disposal Costs

		Gross Cost of Service		Net Cost of Service *	
Structure	Population	$	$/Capita	$	$/Capita
Cities	1,502,504	39,546,588	26.32	25,726,508	17.12
Towns	316,376	8,006,810	25.31	3,604,059	11.39
Villages	47,274	960,341	20.31	484,220	10.24
Summer Villages	3,366	138,494	41.14	136,362	40.51
Counties	252,202	1,929,912	7.65	1,726,099	6.84
M.D.s	109,855	660,552	6.01	606,629	5.52
I.D.s	70,232	334,454	4.76	316,077	4.50
Special Areas	6,042	2,794	0.46	2,794	0.46
Total	2,307,851	51,579,945	22.35	32,602,748	14.13

Source: Alberta Municipal Affairs n.d.

* Gross cost minus revenues.

Assessing the Cost of Landfilling

It is not surprising that the need to fully assess landfilling costs was expressed at the public hearings (36, 45, 78, 92) and at conferences and meetings attended by the Panel. The Ontario Ministry of Environment indicated that incomplete costing of landfilling is a major barrier to establishing energy-from-waste facilities in that province. The Panel agrees and believes that the underestimation of landfilling costs is a major barrier to both recycling and energy from waste.

The federal Department of Energy, Mines and Resources has asked McDaniels Research Ltd. and Quantalytics Inc., of Vancouver, to do a Canada-wide study on incremental landfill disposal costs. Alberta cities that are participating in the study are: Medicine Hat, Lethbridge, Calgary, Red Deer, and Edmonton. The project is expected to be completed in the spring of 1987. The Panel considers this type of investigation essential. Until all costs are fully considered in waste management strategies, the probability for inappropriate decisions will be high. A partial listing of cost elements involved in waste disposal through landfilling would include the following items:

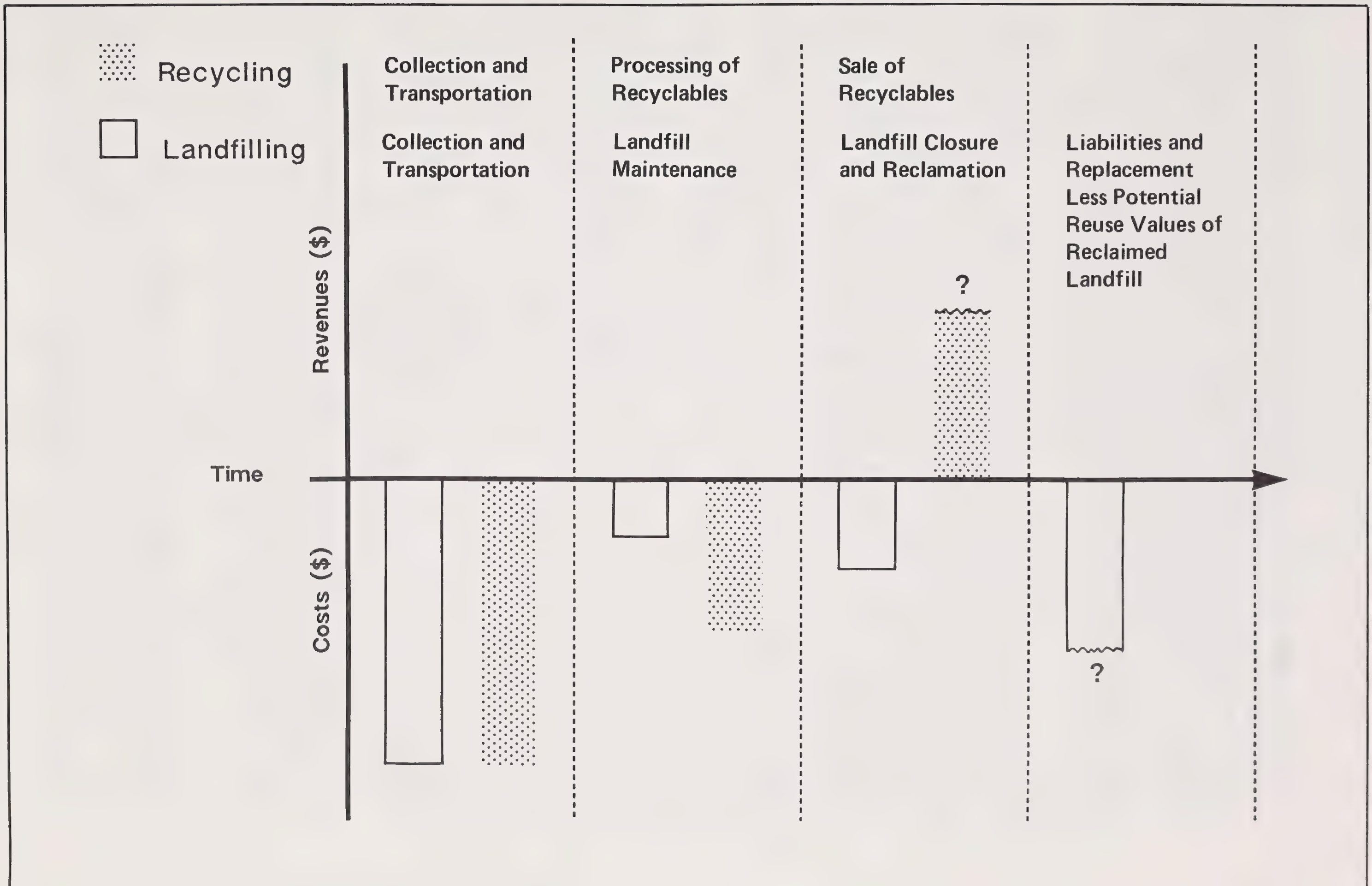
1) collection costs
2) transportation costs
3) depreciation costs for all equipment
4) replacement cost provisions for new sites
5) long-term maintenance costs for the landfill
6) long-term liability costs for the landfill
7) opportunity costs
8) social costs — traffic, noise, odor, littering
9) environmental costs (pollution of air and water).

As the Panel questioned presenters about the costs of landfilling, it became clear that normally collection costs, transportation costs, and present operating costs were considered. Comprehensive assessment of present disposal costs is rare. Most municipalities have great difficulty determining the separate cost components of their present waste disposal system costs, let alone the cost implications of environmental, public health, and legal problems associated with future hazards such as groundwater contamination. It may not be technically feasible to solve all problems associated with an inappropriately sited landfill, regardless of the funding that is available. If the true cost of landfilling were understood, and these costs were borne by the waste generator, then recycling would become more attractive, since with recycling the final product and all production costs are known. This concept is illustrated in Figure 4.

Waste disposal is expensive even as calculated by the municipalities on today's incomplete basis. Alberta municipalities indicate that they spent nearly $52 million on waste collection and disposal in 1985. In addition, private contractors collect and dispose of wastes from many multiple-family dwellings and from the commercial and industrial sector, with direct charges to the users and at no cost to the municipalities. Indeed, "tipping charges" levied on these private waste haulers for the privilege of disposing of their waste loads in the municipal landfill are frequently an important source of municipal revenue and help to lower net costs. Total costs of waste disposal are therefore substantially higher than the $52 million

FIGURE 4

Comparison of Costs and Revenues for Landfilling and Recycling



shown. An estimate of $86 million has been made for total disposal costs in Alberta in 1984 (Lilley 1985a).

It is difficult for a municipality to make prudent waste management decisions in the absence of comprehensive cost estimates.

Recommendation:

> **Alberta Environment and Alberta Municipal Affairs should develop a methodology for the full assessment of landfilling costs, determine those costs for a variety of Alberta situations, and maintain an information base on true landfill costs for use by Alberta municipalities. It would be desirable to integrate the Alberta cost analysis with that being conducted by the federal Department of Energy, Mines and Resources, to avoid duplication and to integrate methodologies as much as possible.**

A number of municipalities of various sizes operate waste management systems on a "cost-recovery" basis with present costs being covered by revenues (see Table 3).

Table 3. 1985 Garbage Collection and Disposal Expenditures and Revenues

Municipality	Expenditure $	Revenue $	Net Revenue $
Lethbridge	1,899,405	2,540,284	640,879
Medicine Hat	1,187,600	1,308,541	120,941
Red Deer	2,162,126	2,272,571	110,445
Coaldale	77,475	124,137	46,662
Peace River	429,891	463,528	33,637
Raymond	33,779	84,237	50,458
Andrew	9,763	17,353	7,590
Legal	12,243	31,687	19,444
M.D. 135 Peace	34,866	36,363	1,497

Source: Alberta Municipal Affairs n.d.

Waste management can become a net revenue generator for a number of reasons, including excellent management practices, the use of realistic tipping fees, and revenue generated from resale of recyclable material such as scrap iron and used lubricating oil. There is also the possibility of low cost through inappropriate disposal and deferral of costs to future generations.

There is also the example of the major metropolitan centers of Edmonton and Calgary subsidizing waste management from general revenue.

Table 4. 1985 Garbage Collection and Disposal Expenditures and Revenues

Municipality	Expenditure $	Revenue $	Net Expenditure $	Subsidy Per Household From Municipal General Revenue $
Edmonton	12,200,000	1,806,000	10,394,000	44.93
Calgary	18,834,000	5,635,000	13,199,000	51.75

Source: Alberta Municipal Affairs n.d.

In the above examples, there have been successful and unsuccessful attempts at balancing revenues and expenditures. Consequently, a great deal of knowledge has been acquired in the municipalities about what to do, and what not to do, if a waste management system is to operate on a cost-recovery basis. This knowledge should be made available to all.

Recommendation:

> **A comprehensive study should be undertaken by Alberta Environment and Alberta Municipal Affairs to determine the conditions for operating municipal waste management systems on a cost-recovery basis. The study should include an analysis of transferability of such approaches to other municipalities.**

The User Pay Principle

It was suggested at the hearings that the waste generator should bear more of the cost of properly disposing of waste (36, 61, 88). This includes the consumer who purchases a product and later discards it. It was also suggested that the price of a product should reflect in some measure the cost of disposing of that product after its useful life has ended (36, 61, 88). This would increase the price of products that are difficult to dispose of, or that produce large quantities of waste. Manufacturers would thus be forced to take disposal costs into consideration in the design and marketing of their products. There is currently no such pressure in the marketplace. Indeed, there are pressures to produce short-lived, easily discarded products with excessive packaging, to satisfy consumer desires for newness and convenience. At the same time, there is almost no appreciation or understanding, on the part of the consumer, of the present and future costs of dealing with the additional wastes such approaches generate (61).

Newness, convenience, and excessive packaging are not free. They are indirectly paid for through high and potentially escalating disposal costs. More realistic product pricing that reflects disposal costs would provide an incentive to design products that last longer and are easily repaired or recycled. Excessive packaging, which was identified at the hearings as a significant source of unnecessary waste, would be reduced. Consumers would be provided with information about the added costs associated with superfluous packaging or the convenience of single-use disposable products. As long as waste disposal costs are carried predominantly by the public sector, there is no incentive to the manufacturer, distributor, or user to reduce waste or increase recyclability. One incentive to change this is to adopt a "user pay" principle (28).

Recommendation:

> **The Government of Alberta should adopt, as a policy, the principle of "user pay" for municipal waste management systems.**

At the municipal level, an approach that would facilitate operating on a "user pay" principle would be to designate waste management systems as a utility. Public utilities such as water, sewer, telephone, and electricity are intended to be fiscally self-sufficient, with total revenues balanced against total costs, even though the service may be provided by municipal government. This is not the case for waste management.

Subsidies from general municipal revenue or the provincial government lower the direct charges for collection and disposal of garbage, and have the following undesirable effects:

1) Since perceived costs are lowered by the subsidy, the generator has no idea of the true cost of waste management.

2) There is little clear relation between volume of waste generated and the cost of its disposal, since most of the cost is hidden in the general mill rate or business tax.

3) Recycling looks expensive in comparison to garbage disposal, since recycling is expected to cover the full cost of collection and processing while disposal to landfill is heavily subsidized.

Recommendation:

> **The Municipal Government Act should be amended to require that waste management be treated as a utility, and be self-supporting on the basis of revenue generated.**

Single-family householders are the principal beneficiaries of present subsidies for garbage disposal costs. Municipalities may be concerned that an increase in waste disposal charges for householders may be unfair, particularly for low-income earners and the elderly. However, the Panel does not believe that the most effective support for disadvantaged householders is a shielding from the full costs of a service that is provided to both rich and poor on the same basis. Householders are not shielded from the full cost of water and sewer services. There are other, more equitable ways to help the poor, ones that do not subsidize the production of garbage.

The provincial government funds a program that encourages the development of regional landfills, and this program has been beneficial in upgrading the quality of waste management in Alberta. However, the Panel does not believe that municipalities should be persuaded with subsidies to do what should be their responsibility. The responsibility for waste management includes collecting and disposing of garbage in a manner that does not pollute the environment. By making special funding assistance available to municipalities for regional landfills, the Province shows a clear preference for that particular solution to the waste disposal problem. The assistance provided lowers landfill cost to the municipalities and creates an artificial preference for landfill as the "cheapest" method of waste disposal. Therefore, the Province should phase out this program.

In recognition that landfill disposal will still be required for many years into the future, the Province should continue to assist municipalities. This assistance should be in the form of technical assistance, engineering, and testing of landfill sites for physical suitability. There should also be vigorous enforcement of environmental standards at old dumps, nuisance grounds, and sub-standard landfills.

The funds freed up from the support for regional landfills should be made available as an incentive for recycling. However, as discussed in Section VII A, provincial support should be considered in exactly the same light as support for any industrial development program, to cover unusual development or start-up costs for what should be self-supporting, economically viable enterprises.

Recommendation:

> **Alberta Environment should phase out its capital assistance program for development of regional landfills and make the funds that are freed up available as incentives for recycling.**

Metering Wastes

The above recommendations should lead toward an improved understanding of the cost implications of waste collection and of the use of landfills as a disposal method. They should also tend to reduce demand for waste management services. In most instances where reducing the demand for excess services is an objective, some form of metering is in effect. That means that extra volumes of water, telephone calls, or electrical consumption are permitted, but at some charge that relates to the cost of the service. It is quite clear that, where flat charges or funding from general revenues are used, excessive amounts of the good or service, whether water, electricity, or waste disposal services, will be consumed.

Ideally, the full cost of garbage disposal should be charged to the waste generator (36, 88). The full application of the principle of "user pay" would see an attempt to relate volume of waste generated to disposal charges (59, 61). The major difficulty with this approach may be administrative complexity. The metering of garbage collection would require some method of charging for increasing volumes, and provide for reduced charges for reduced volumes.

Waste generated from single-family dwellings could be metered in several ways. A standard, mandatory garbage bag could be sold through ordinary retail outlets (36, 80). The more waste a household generates, the more bags they would have to purchase. In Seattle, Washington, homeowners indicate the number of bags of refuse that they expect to produce per week and are charged accordingly. An enforcement officer spot-checks on collection day to ensure that people are not setting out more bags of refuse than they had indicated and paid for. Another means of discouraging household waste generation is to set an upper limit on the amount of refuse that will be collected. Local bylaws can restrict the number of refuse containers per household that collection crews will empty. The City of Edmonton, for example, limits residential collection to eight containers per dwelling per week (90). However, these types of limits usually are not enforced stringently.

There is a down side to metering proposals, in that anything that makes waste disposal appear more costly or difficult may result in surreptitious dumping in remote ditches and public places (31). The problem is a real one and varies in seriousness depending on public attitudes and successful enforcement of anti-littering bylaws.

The Panel is not convinced that the technology for metering garbage is sufficiently well established to identify an advantage for any particular system, particularly when multiple-family dwellings are considered. The Panel's concern for the administrative complexity of metering garbage deters it from recommending a metering approach, unless a municipality is comfortable with it. If a municipality could find a metering system that was simple, efficient, and effective, the Panel would urge its adoption. In this context, the Panel sees a provincial government role in providing an information base for municipalities that may wish to evaluate the metering option.

Recommendation:

> **Alberta Environment and Alberta Municipal Affairs should examine the practicality of different methods of "metering" waste collection and charging accordingly. Information obtained should be developed in a form that is readily accessible to municipalities to allow them to choose the metering approach that most adequately fits their situation.**

Industrial waste generators are already partially subject to metering, usually through the payment of commercial hauling rates for waste collection. However, present tipping fees seldom reflect all the costs associated with landfilling. Tipping fees should increase substantially as landfill costing studies identify the full costs of landfilling and these costs are shifted to the waste generator from the general taxpayer.

Industry is also a major generator of hazardous or special wastes. These wastes should not be disposed of in an ordinary municipal landfill. When the Special Waste Treatment Facility at Swan Hills becomes operational, these wastes will be increasingly diverted to the Swan Hills facility. Since this facility is being operated on an "at cost" basis by a private company, industries will then be paying the full cost of adequate and acceptable disposal of special wastes, that is, comprehensive metering. There is no doubt that, on being faced with these full costs, industry will have a powerful incentive to look to alternative methods of waste management, including the "Four R's" of waste management described more fully in Chapter III.

The recommendations in this section should highlight the costs of present waste management systems to the public, to the private sector, and to government. They provide a basis for evaluating a new approach to waste management that looks at ways to reduce waste, reuse products, recycle materials, and recover resources — the Four R's of Waste Management. Discussion of the Four R's begins in the next chapter.

III. THE FOUR R's OF WASTE MANAGEMENT

The generic term "recycling" is used in the title of this public hearing to cover all aspects of the recovery and reuse of resources. However, more detailed strategies for waste management have been developed in Canada and the United States. The Panel has chosen the strategy referred to as the "Four R's" of waste management: Reduce, Reuse, Recycle, and Recover. As Albertans develop a new approach toward waste management, they should consider the Four R's: *reduce* the production of waste, *reuse* products instead of discarding them, *recycle* materials into new products, and *recover* useful materials or energy from waste.

Wastes are an inevitable but unwelcome byproduct of production and consumption. One premise underlying the Four R's approach is that wastes should be handled in the manner that most effectively reduces the environmental, social, health, and economic burdens their disposal represents. This approach recognizes that no economic benefit is gained from the disposal of wastes, and that there may be unknown liabilities in future treatment and clean-up costs. Therefore, anything that can be done to reduce the amount of waste will reduce disposal costs. Another underlying premise is that a reduction in waste improves the efficiency of resource use and that a given amount of resources will produce more final product. The Four R's represent waste management priorities and, taken in sequence, the most efficient strategy for improving waste management. Each step, from reduce through to recover, represents the least investment of energy, time, or money toward the goal of eliminating waste.

The adoption of the Four R's as the government's policy and priority in waste management should result in a close examination of the government's own waste management practices as well as careful scrutiny of the impacts of government policies on recycling in the private sector. Later in this report specific recommendations are made to encourage the use of recycled materials by government departments and to increase the recovery of recyclables from these same departments. Recommendations are made whereby the provincial government can encourage municipalities to reduce their dependence on landfilling as the primary disposal practice. Other recommendations are aimed at increasing the collection and recycling of materials in all sectors of Alberta's economy. A commitment by the Government of Alberta to the Four R's of waste management should have a important impact on the future of waste management and development of the recycling industry in Alberta.

Recommendation:

> **The Government of Alberta should adopt the "Four R's" — reduce, reuse, recycle, and recover — as its policy and priority sequence in waste management.**

A. REDUCE

Taking preventative steps before waste is generated reduces the environmental hazards posed by waste disposal, the overall waste management costs, and landfill space requirements, and avoids some of the environmental and social problems of landfill siting and operation. It is a proactive approach. Although the hearings addressed specifically the recycling of waste materials, a number of people commented that reduction in waste production should be the first step toward more efficient waste management and an integral part of improved resource recycling (63, 68, 80, 88, 90, 132).

Opportunities for controlling waste exist in improved planning or modification of material requirements and material flow. Modifications to product design may be a major component in reducing the volume of waste per unit of output and can improve reuse, recyclability, and product life, thus indirectly reducing waste generation (10, 80, 81, 113).

We are familiar with the use of time managers to assess industrial operations, improve operating efficiency, and increase output. Now waste managers are conducting similar assessments. For example, a co-operative industry-government program operating in Ontario and the Maritimes places qualified unemployed graduates in small and mid-size companies that have environmental control problems (Energy Pathways Inc. n.d.). These people assess company operations and recommend actions to reduce, reuse, or recycle wastes. Participating companies have improved waste management and reduced waste production, usually at a savings to the company. Many of the companies have decided to retain the environmental control personnel on a full-time basis. Most large companies already have waste management personnel. As well, Environment Canada and some provincial governments have personnel who can provide waste management advice to industry. As waste management costs increase and stricter requirements are placed on the disposal of hazardous wastes, the value of improvements in waste management will become more noticeable.

Recommendation:

> **The Alberta Research Council, in consultation with industry, should develop a "waste audit" program to assess waste management practices in appropriate industrial and commercial businesses and provide advice on ways to reduce waste generation.**

The Alberta Research Council should have the capability to provide advice on ways to reduce or recycle waste materials. This advice will become critical when the special waste treatment plant is opened and alternative disposal options for hazardous wastes are closed.

However, this service should not be restricted to special wastes, but should consider the whole spectrum of waste reduction and the Four R's approach.

Household waste also can be reduced. But the options open to the individual are few and even these few are sometimes hampered by government policies. Excessive packaging is a problem for individuals concerned about recycling and improved waste management (21, 55, 63, 78, 83, 86). Often there is little choice but to accept the excess packaging (61), although boycotting of certain products is an option (80). Purchasing food in bulk is one alternative.

Excessive packaging contributes to waste disposal costs and may lead to increased littering. When products are designed, the fate of the used product should be considered. Alterations might facilitate recycling. In particular, fast food outlets should review their product packaging to determine ways of reducing the amount of waste and the likelihood of it becoming litter. The production of non-degradable products could be taxed and the revenue used to sponsor and promote recycling (47). A publicity campaign would increase public awareness and discourage use of overpackaged products (78).

Improvements in product design may require federal government involvement because of its responsibilities for packaging standards (10). There also are health-related regulations for packaging (75). But, if possible, the provincial government should take action, through policies, legislation, or taxes, to encourage the design of goods and packaging that are recyclable and minimize waste (46, 63, 80, 86). The Panel recognizes the role of the federal government in the control of packaging and labelling and in Section VII D recommends a joint federal-provincial effort to incorporate environmental considerations into product design and labelling.

Another way to reduce waste is to improve the quality and durability of products, thereby increasing their life spans and reducing the flow of materials through the economy (55, 61, 78, 80). For some products, such as plastic garbage bags or containers, improved degradability after landfilling would be desirable. Products could be labelled with the expected life span in the same way that products are labelled with information about energy consumption (80). Discarded but useful products should be reused.

B. REUSE

Reuse, the second of the Four R's, refers to the repeated use of a product in the same form and usually for the same purpose as originally intended. Reuse reduces waste generation, conserves raw materials used in production, and may result in cost savings to the consumer. Reuse, for example, includes the use and return of refillable beverage containers, the purchase and use of secondhand goods, the repair of broken products, and renovation rather than demolition and reconstruction of buildings.

The reuse of refillable beverage containers was said to be less expensive than the use of non-refillable containers (101). The use of refillable containers requires a collection system; sorting by size, color and manufacturer; and return to the bottler, but these costs are offset by savings in material and disposal costs, and improved environmental protection. The environmental benefits of reuse are discussed in more detail in *Economic Barriers to Recycling* (Webb 1985), one of the background reports prepared for the hearings. That discussion indicates that if the energy requirements associated with the use of refillable bottles are amortized over 10 uses, they are about 30 percent of the energy of non-refillable bottles and 19 percent of that for aluminum cans (Webb 1985). When all stages in the use of containers are considered, including manufacture, packaging, and refilling, the use of refillable bottles entails only 41 percent of the air- and water-borne emissions associated with the manufacture and use of a non-returnable bottle and 34 percent of the emissions for aluminum containers (Webb 1985).

Sorting is a significant part of the labor and space requirements in a bottle depot or in a retail store and recycling of refillable bottles has been made less convenient by the change from a uniform stubby beer bottle to a variety of beer bottle shapes (10). Although the change to long-necked, unique-design bottles may have brought temporary market gains, the move has increased production and handling costs. A long-necked bottle is more susceptible to breakage and the number of trips for refilling is greatly reduced (13). Standardization of containers would encourage recycling (71). In addition, a clear, visible distinction between refillable and non-refillable beverage containers would make the choice easier for the consumer (57).

It was pointed out that often the reuse of products depends on the development of appropriate attitudes. It may be that society as a whole has been conditioned to believe that new means good and old is dirty (61). This attitude must be changed — we must learn to reuse our consumer goods (100), beginning with something as simple as reusing shopping bags (44, 63). A start can be made by practicing a recycling ethic at home (101). An example was cited from Germany, where twice each year a city-wide program encourages everyone to place unwanted items out on the street. During a 24-hour period anyone may pick up items of use. All remaining items then are picked up for disposal (103).

Renovation and reuse of older buildings was an option supported by some (71, 78, 80). Where reuse of the buildings is not feasible, reuse of their constituent materials is preferable to landfilling (43, 61, 80).

The public commitment to more efficient use of resources is indicated by the broad range of materials and products that were considered for reuse. Although we may live in a "consumer society," many people do not like to see items discarded before the end of their useful lives. The use of secondhand goods should be encouraged (54, 80, 87, 122). Other ideas included a warehousing center for larger items (80) and shipment of government surplus materials to Third World countries for repair or use (100).

Opportunities for the reuse of many items are available through a vast array of mechanisms for selling secondhand goods. These opportunities include garage sales; farm auctions; flea markets; farmer's markets; newspaper advertisements; ski, skate, and bike exchanges; thrift stores; and postings on notice boards. Industrial wastes may be bought, sold, or transferred through the Alberta Waste Materials Exchange. These mechanisms attempt to find a buyer for goods that are no longer useful to the owner but may be useful to others. Goods may also be given to charities, churches, or local organizations to be sold to raise money for their operations.

The Panel feels that these outlets are resulting in substantial reuse of goods. Particularly in recent years, there has been an increase in reusing materials through exchanges such as garage sales and flea markets. The development of these outlets is good and is happening naturally; this is perhaps itself a reflection of changing attitudes.

C. RECYCLE

In the Four R's of waste management, "recycle" can be defined as the use of materials contained in products otherwise discarded as waste. These materials are used in new products with a minimum of change to their basic nature. Recycle differs from reuse because it is not the product itself that is reused, but rather the material that makes up the product. Paper is reprocessed, metal is reformed, and plastic may be made into other plastic products. Recycling differs from recovery because it does not involve major modification of the material during its extraction from the product, as does, for example, the recovery of energy or the recovery of oil through pyrolysis.

During the hearings, the Panel noted an overwhelming support for waste reduction and especially for the role that recycling could play. Support for recycling is perhaps a reflection of the experience of people who lived through the Depression when "waste not, want not" was the attitude of the day. But a broad cross-section of society supports recycling (11, 22, 34, 48, 56, 61, 97, 99, 101, 103, 111, 125, 127, 132) and often those too young to have experienced the Depression are involved with recycling projects. Current interest in recycling seems to be based on concerns about waste, stewardship, protection of the environment, and a desire to "live lightly on the Earth" (15, 24, 28, 34, 61, 80, 88, 113, 114, 118).

Recycling is seen as a desirable and socially acceptable part of a waste management strategy — it is seen as a means of protecting the environment, reducing waste, conserving resources, and reducing landfill requirements. However, environmental and social costs of recycling should be considered along with the benefits of recycling. The collection and processing of recycled materials may cause air or water emissions and may create their own disposal problems. For example, the re-refining process for used oil in Alberta produces odorous air emissions and an acid-clay sludge that may require treatment as a special waste. De-inking of newsprint requires the addition of chemicals to lift off the ink and clean the fibers. The process water used must be treated prior to disposal, and solid residues must be disposed of. A major benefit, however, is that the volume of waste from recycling is a fraction of the original waste material and the residue is of a known and uniform quality, making further treatment or disposal easier.

There is an active interest in recycling in Alberta, particularly by non-profit organizations. Municipalities also support recycling, in part because recycling can reduce landfilling costs (69). For example, special areas are set aside for recyclables at many landfills. Municipal waste management staff often advise recyclers of potential sources of recyclable materials (31). The City of Calgary has participated in a study of the feasibility of collecting cardboard at the landfill face, and in October 1986, the City of Edmonton commenced a one-year pilot project for curbside collection of recyclables. Interest in the separation of materials from domestic waste seems to be growing although, as yet, there is only limited involvement by private sector companies.

Private sector enterprises are more interested in recovery of materials from industrial sources. Waste disposal companies may reduce their overall disposal costs by separating and selling recyclable material collected from their clients instead of taking it to a landfill. The industrial waste generators benefit from reduced waste disposal costs and, at times, payment for their wastes; for example, producers of metal scrap usually sell their scrap. Large generators of cardboard, such as the breweries, are long-time sources of old cardboard (D. Hall 1986: pers. comm.). The Alberta Waste Materials Exchange has played a role in increasing awareness of the types of materials presently being discarded as waste that could be used by others.

It was clear that there was no opposition to recycling by the public; indeed there was general support for the idea, although this may not be translated into direct action unless such action represents an easy alternative to normal waste disposal. There is a pervasive desire to recycle, but even small barriers to recycling can dissuade many from doing so.

Recycling is often considered inconvenient, hampered as it is by the lack of recycling facilities, by government policies, and by the design of products. People would prefer to have more convenient opportunities for recycling. It was stated that, given the opportunity, many people would recycle (60, 119, 132). Suggestions to achieve more opportunities included: the use of depots and drop-off centers for collection of materials (37, 38, 47, 56, 91, 114, 128, 132) and curbside collection of recyclables (3, 18, 37, 44, 47, 64, 76, 87, 91, 99, 114, 119, 125, 128, 129). Increased education about recycling and "how to" information on recycling were also requested (9, 10, 16, 19, 21, 47, 48, 49, 73, 77, 78, 91, 95, 101, 103, 113).

During the hearings, many people suggested that incentives are needed to get recycling projects established. A wide variety of options were suggested including: financial support (2, 10, 59, 76, 101, 120, 131), tax credits or rebates for the use of recycled materials (43, 59, 103), subsidized market prices (10, 18, 38, 59, 65, 90), support for research (79), promotional and market development support (48), and assistance with transportation costs (21, 106).

Many other comments related to recognition of the true costs of landfilling, the desirability of recycling as a waste management option and the savings in waste disposal costs created by the removal of materials from wastes destined for landfill (3, 23, 28, 42, 44, 66, 71, 76, 78, 80, 91, 92, 132).

Many people also felt that recycling is hampered by present government policies that support development and transportation of primary resources. Many of the costs of these resources may not be fully accounted for in the cost of finished products. If the true costs of consumer goods, including the full cost of resource extraction and waste disposal as well as manufacturing costs, were accurately accounted for, then recycling would be encouraged. Because resource extraction often is subsidized by government support and taxation policies, the use of recycled materials appears to be uneconomic. Recycling industries should be treated equitably in an economic sense, through similar government support or the removal of support for resource extraction industries (15, 38, 78, 79, 86, 88, 90, 107, 111). This would be a major step toward improving the perceived economics of recycling.

As well as simply reducing the volume of waste, improved product design could facilitate recycling. Changes in the design of the PET beverage container have been introduced by some manufacturers; they have replaced glued-on paper labels and metal caps with shrink-wrap PET labels and plastic caps. This improves the recyclability of the bottle; it also improves waste management at the point of manufacture by reducing the production of paper and metal wastes. The potential for improving packaging and design of products to improve recyclability deserves the combined attention of the provincial and federal governments.

One reason why more consideration is not given to product recyclability is that the manufacturer is not the recycler. Where the manufacturer is also the recycler or where, for other reasons, the manufacturer wishes to promote recyclability as a marketing feature, more care is taken in the initial design. For example, the steel industry is developing an all-steel can to improve its recyclability in the face of increasing competition from the aluminum can. The plastic industry is researching recycling of plastics to address concerns about the growing amount of plastic in the waste stream.

Recycling occurs for a variety of reasons. The most crucial is demand for the material. Demand develops over time, as recyclable material becomes more readily available, as raw materials become scarcer, or as legislation creates a market. Demand for recycled materials, in most circumstances, follows a progression related to the maturity of the primary industry that manufactures products containing the virgin materials. A recycling industry develops in conjunction with but lagging behind the primary industry. The rate of development of demand will vary dramatically among materials, from location to location, and depending on various social and economic factors. The situation in Alberta is unique because of our geographical location and the influence of the Beverage Container Act.

Alberta has no economically exploitable iron ore deposits, and the province is distant from major producers of steel and steel products. As a result, a successful steel industry has developed based on the availability of scrap. The industry is mature, stable, and dependent on recycling, to the point of importing scrap into the province. The manufacturer of the steel is also the user of the scrap. Scrap steel has a reasonable value, its recovery is encouraged, and an extensive network of collectors has developed. As well, to enhance the image of steel products as recyclable, the industry recycles tin cans even though they are not a desirable feedstock.

In Alberta, the glass and paper industries depend less upon recycling. Demand for cullet and scrap paper depends partly on the needs of industries that use only recycled materials, but also on virgin material feedstocks, the price of which are often determined nationally or internationally. For some products, for example, cellulose insulation, recycled material must also compete in quality and price with substitute materials such as fiberglass. Recovery of glass and paper must be carefully matched with demand, which could be increased either by expansion of existing uses or through development of new uses.

Recycling of aluminum in Alberta is in its infancy. Aluminum is made available through provisions of the Beverage Container Act that result in collection of aluminum containers. Aluminum is not recycled in Alberta; it is only baled and shipped to out-of-province markets. However, recycling of aluminum is strongly entrenched in other locations, particularly the United States. Aluminum can be recycled with major energy savings — up to 96 percent. Recycling reduces costs and maintains markets in the face of competition from other packaging materials. Thus markets are strong, the commodity is valuable, and materials recovery is feasible.

Recycling of post-consumer plastics presents considerable difficulties. Encouraged by the availability of plastic bottles collected through the universal depot system, Applied Polymer Research Ltd. is developing uses for this recycled material (96). But there is little incentive to collect and recycle other plastics. Raw materials are inexpensive, and quality control for reprocessed plastics is a major concern. Major producers of plastic resins or products are not the users of recovered post-consumer plastics. Two parallel industries seem to be emerging, one based on virgin materials exclusively, the other based primarily on post-consumer plastics. As yet, this latter industry has not fully developed.

Although plastics are a late arrival in the waste stream, they arrive at a time when there is increasing interest in recycling as a means of reducing waste generation. The present level of plastic recycling is unacceptable. It is inconsistent that a high level of recycling should be achieved by the steel, aluminum, paper, and glass industries while the plastics industry has yet to develop similar levels of recycling. The industry will be faced with increasing pressure to do its part to increase the recyclability of its products. Already plastic bags and other non-recyclable packaging materials are being banned in Italy (*Ontario Recycling Update* 1985), and the Ontario government is requiring plastic beverage containers to achieve the same level of recovery as other containers, regardless of market conditions (Ontario Regulation 623/85). If the industry does not assume responsibility, more controls are likely to follow.

D. RECOVER

Recover is the fourth of the Four R's of waste management: recover useful materials or energy. In the hierarchy of waste management options, recovering energy or materials is perhaps the least favorable. But, it may not be viable to reduce, reuse, or recycle some products. Some waste will always be produced even though substantial reductions are possible. It may be possible to process the discarded resources to recover some of the energy or material value. Three main technologies are considered here: composting, pyrolysis, and incineration with energy recovery.

1. COMPOSTING OF ORGANIC MATERIAL

A large fraction of the waste entering landfills is food and vegetable matter, including, on a seasonal basis, large amounts of vegetation from gardens, yards, and parks. Some studies have shown that during the spring and fall clean-up periods up to 36 percent by weight of the landfilled material may be of this nature (City of Edmonton 1985). In addition, paper material in the waste stream is organic matter that could be composted, if it were shredded and moistened. Sewage sludge, agricultural wastes, and wastes from food and animal processing industries are other sources of organic matter.

Composted organic matter can be used as a soil conditioner, top dressing, or as soil in reclamation areas (109), and is a potential source of nutrients and fiber. Recycling of organic matter would reduce considerably the volume of material landfilled, extend landfill life, and produce a useful commodity.

Many large generators of organic wastes recycle their wastes. The Panel heard that food processors in southern Alberta use their byproduct as animal feed (28). Sewage sludge from several municipalities is spread on land owned by the municipality or is given to local farmers for use as a fertilizer. Sewage sludge is an excellent source of nutrients as long as adequate precautions are taken to avoid excessive application and soil contamination with heavy metals, nitrates, or other contaminants. Several municipalities dispose of their sewage effluent through irrigation. Manure is spread as fertilizer on agricultural lands. Manure from the race track in Calgary is sometimes used by local mushroom farms. The used mushroom "soil" is then taken back by the City and used in its parks. Many individuals also compost their garden refuse.

All too often, organic wastes from households, restaurants, food stores, and municipal parks and boulevards as well as sewage sludge and manure are landfilled. At the public hearings, composting of municipal solid waste was viewed favorably by several people (21, 26, 63, 70, 71, 83, 101, 103, 117). The briefs included many suggestions. It was suggested that food waste could be collected and used as pig feed (83). Similarly, grass clippings could be collected and used as cattle feed (116).

A proposal was made by Rural Development Project No. 4 in conjunction with eight member communities, on behalf of the Village of Ryley, to acquire a solid waste recycling pilot plant. The proposal was to accept the organic fraction of Edmonton's municipal waste and prepare compost for use in upgrading farmland, reclaiming mine sites, and possibly for sale in bagged form (70). This proposal would address Edmonton's present problem of lack of landfill space while also producing usable materials. The plant could also accept organic waste from other area communities.

Composting is a well-known technology and several different useful approaches have been developed. These range from "high tech" to "home grown" solutions. For example, the Ontario Centre for Resource Recovery used technology similar to sewage sludge digesters to compost organic material in about seven days. Ground-up material is mixed with liquid, including partially dewatered sewage sludge. It then flows into a digester, where it is aerated to maintain rapid aerobic digestion. The composted material was placed on outdoor pads for drying and curing. Prior to sale it was screened to remove oversized pieces.

Less capital-intensive approaches include Grow-Rich in Welland, Ontario, a company that composts organic waste from a paper recycling and de-inking plant. The moist material is inoculated, piled outdoors, and turned periodically. It is later brought inside for drying and screening. Some of the compost is bagged for sale through retail outlets; the rest is shipped in bulk to market gardeners, tree farms, golf courses, and other users.

Various materials can be composted in this manner. In Seattle, 40 tonnes per month of manure and bedding straw from the Zoo as well as chipped wood from city brush clearing and trimming are composted in an area about the size of an average city lot. This operation uses windrows of material that are turned once per week to maintain aerobic action. Food material and manure from the carnivores are not included. Composting is complete in about seven weeks. Clients are allowed bimonthly public access to the site to load compost in garbage bags, cans, or pick-up trucks. The Seattle Zoo saves about $14,000 per year based on avoided landfill costs and revenue from the sale of compost.

Household food and yard wastes can be composted with equipment ranging from a simple wire cage for leaves to a more elaborate three-compartment composting bin. Meat scraps and fatty material normally are not included due to concerns about smell and attracting pests. Some jurisdictions have taken active steps to encourage composting. For example, composting barrels were delivered to 1,000 homes in Kitchener, Ontario to determine the public's interest in composting (*Ontario Recycling Update* 1986a). Public acceptance was high and a surprising number of people (43 percent) continued to use their composting barrels through the winter for their food wastes.

Recently, the Region of Peel, Ontario distributed 500 composting barrels on a first-come, first-served basis. The program was promoted through a notice enclosed with the utility bill. As well, a brochure on how to compost was sent out. The first 500 barrels were claimed quickly and at least 600 additional requests for barrels were received. The Region estimates that 35 percent of residential garbage can be composted (*Ontario Recycling Update* 1986b).

Seattle is also promoting composting at the individual level. The residents have the added incentive of per-bag charges for garbage collection and rapidly raising disposal costs. A composting information and demonstration site was established and supported by the City. A "composting hotline" was set up and advertised via the utility bill. During the first three months of operation, about 5,000 calls were received requesting more information about composting techniques. The center also has a training course for "Master Composters." After taking this intensive course, these people are expected to talk to other community organizations and to help people start composting efforts in their backyards.

Because of the climate, composting is likely to remain a seasonal activity in Alberta, but the production of organic material is also largely seasonal. Composting has the potential to reduce considerably the noticeable peaks in waste generation (and the consequent peaks in operating costs) during the summer months. As well, composting offers benefits in reduced landfill needs, and recycles organic matter back to the soil. An alternative to composting in a bin or barrel is to cut lawns more frequently and leave the clippings to decompose on the lawn (18).

There is, in Edmonton, an excellent opportunity to assess individual receptivity to the idea of composting and to measure the impact that composting at the household level may have on the volume of municipal waste. Three areas of the city are currently participating in a pilot curbside collection program. A good data base exists for past and present waste generation rates and levels of recovery of recyclables. Implementation of a program to encourage composting in the pilot areas would add greatly to the developing information base on the impact of recycling on the waste stream. As a first step, a suitable information package should be developed, based on existing publications such as Agriculture Canada's pamphlet on composting (Cole 1979).

Recommendation:

> **Alberta Environment should develop an information package on backyard composting methods and the advantages of composting.**

The information package should be readily available to all Albertans, but should be used specifically to study the effects of composting on the municipal waste stream in those areas of Edmonton presently taking part in the pilot recycling project.

Recommendation:

> **Alberta Environment and the City of Edmonton should implement an experimental composting project in those areas of Edmonton currently served by the curbside recycling project.**

Detailed information is being collected in those areas about waste generation rates and the impact of recycling. A project that used these same areas to assess the impact of various approaches to backyard composting would be simplified by the existing information network and data base. Depending on the results of this project, the composting program could be expanded to other municipalities.

Few municipalities in Alberta compost organic material collected from parks, boulevards, tree-trimming operations, or other sources. Experience elsewhere has shown that substantial volumes of organic material can be composted in a relatively small area and with minimal equipment. Although the winter climate of Alberta is harsh, composting can be undertaken easily and quickly during the summer months. Composting could be done at an area set aside at the landfill, using equipment available there. The composted material could be used in reclamation of the landfill site, used in the parks, or sold. The benefits of composting will be evident not only in the production of usable compost, but also in savings in landfill requirements, savings in disposal costs, and an improved public image.

Recommendation:

> **Alberta Environment should work with large producers of organic material, such as city parks departments, zoos, and racetracks, to encourage the establishment of composting areas at landfills or other suitable locations.**

2. PYROLYSIS

In simple terms, pyrolysis is incomplete combustion of materials under oxygen-starved conditions. Pyrolysis has several advantages over incineration, including production of useful byproducts (Moell 1975). Pyrolysis produces heat, and fuels such as oils, gases, and tars. An ash residue is also formed from which materials such as metals may be recovered.

An experimental pyrolysis plant operated near Lethbridge for about one year. Apparently the facility worked well on homogeneous wastes such as paunch waste* and wood chips (32), but was not cost effective (31). As well, difficulties were encountered with the raw material feed mechanism and the movement of materials through the pyrolytic convertor (31).

Three briefs suggested that pyrolysis could be used to extract useful material such as oil, gas, heat, and carbon black from discarded tires (101, 110, 112). This treatment of tires was said to be cost effective, and to produce no smoke (112). Pyrolysis has been used in the United States to decompose tires (Dodds et al. 1983), but it proved difficult to recover material of high and consistent quality and hence the recovered carbon black could not be marketed.

Another brief suggested that pyrolysis could process mixed waste to produce light and heavy oils and metals. Ash would be the only waste product and there would be no other emissions to the environment (98). This view was countered by a brief that stated that pyrolysis remains technically and economically unproven (58). As well, literature reviews show that pyrolysis plants have frequent problems, especially when dealing with heterogeneous materials such as municipal waste (62). As a result of the varying material input, the quality of outputs varies. Quality control of products is important because the plant is not the end user of the products but must sell them on the open market (62). The skepticism about pyrolysis for treatment of municipal solid waste was shared by federal government officials with the Department of Energy, Mines and Resources (E. Kilotat 1986: pers. comm.).

Pyrolysis does offer some advantage over energy-from-waste in the recovery of liquid or solid fuels that can be readily transported to markets. However, Alberta produces an abundance of fuels from its natural resources. It is unlikely that fuels produced by pyrolysis will be able to compete with fuels from petroleum sources in the near term. Given the uncertainties of past operating experience and the likely difficulty of marketing products from pyrolysis plants, it is the Panel's view that this technology is unlikely to see commercial development in Alberta soon.

3. ENERGY FROM WASTE

Incineration of municipal solid waste has been discussed in Section IIC. Energy-from-waste projects differ from conventional incineration by providing for heat recovery. The recovered heat may be used to produce steam for direct use or for the production of electricity. The advantage of energy-from-waste plants over straight incineration is the ability to recover a usable commodity — energy.

Municipal solid waste can also be used to produce refuse-derived fuel — a processed, burnable fraction of municipal solid waste (84, 92). The processed fuel is more uniform than the unprocessed waste and can be more easily handled and transported, opening new markets.

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* Paunch waste is material removed from the first stomach of ruminants when they are slaughtered.

However, production of refuse-derived fuel generally is not economically feasible unless competitive fuels are costly (84). This option is not discussed further here, but more information is available in the background information report *The Use of Municipal Waste As Fuel* (Webb 1983).

The Panel believes that reuse and recycling should be given priority over recovery of energy. Energy-from-waste alternatives should be encouraged only if other uses of the materials are not feasible (103, 113). Recycling programs, source separation, and removal of materials including rubble, white goods* (62), glass, and metals improve the operation of energy-from-waste facilities (58, 84). There will always be a residual waste that can be incinerated. Energy-from-waste plants and recycling are compatible if the plant is designed for the residual rather than for the total waste stream (92). Regulations requiring that all wastes go to an energy-from-waste plant should not be used to support the fuel requirements of the plant (92).

Although some briefs supported the concept of energy from waste (4, 113), others commented that recovering energy from waste is not a feasible option in Alberta because of high capital costs, and the low cost of competitive energy sources (10, 19, 62, 84). If waste is to be incinerated, then the provincial government will need to assist with the capital financing (4, 31, 90). Landfilling apparently is still the least expensive waste management option (10, 90), although others argued that if all of the costs of landfilling were considered, then the energy-from-waste option was not more expensive (4).

While energy recovery is often associated with incineration of municipal solid waste, many industrial plants and large institutions incinerate their burnable wastes to produce steam for heating. Energy-from-waste plants are common in Europe, where energy prices are high and landfill space is scarce and expensive. Energy from waste is gaining popularity in North America and in parts of Canada. The Ontario Ministry of Environment is promoting energy from waste as a primary strategy for reducing reliance on landfilling in that province. The Greater Vancouver Regional District will soon be sending municipal solid waste to a new energy-from-waste plant in Burnaby, British Columbia. In Alberta, however, low prices for conventional energy and perceived low costs for landfilling thus far have discouraged the development of such plants (10, 19, 62, 84). This situation is exacerbated by the present Alberta Gas Protection Plan, through which the provincial government pays approximately one third of the cost of natural gas to most consumers (K. Charters 1986; pers. comm.). If materials are incinerated to produce electricity for use within the plant or institution, written approval must be obtained from the electric utilities (K. Charters 1986; pers. comm.).

The purchaser of steam from the Greater Vancouver Regional District energy-from-waste plant is a paper products recycler located across the road. The user of steam from the Charlottetown municipal solid waste energy plant is a nearby hospital. In Alberta, district heating (113) and office building heating (36, 55) were suggested as potential users of steam, and a study is under way on the feasibility of using energy from waste for district heating in west Edmonton (62). Using the heat in greenhouses or in aquaculture was also suggested (36).

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* "White goods" is a general term for large household appliances such as stoves, refrigerators, and washing machines.

Markets are the key to successful energy-from-waste plants (62, 113). If steam is produced, the customer must be located near enough to allow economical conveyance of steam from the energy-from-waste plant to the user. As well, the demand for steam should parallel production from the energy-from-waste plant. Fortunately, steam is used in many industrial processes and can be used both for heating and to run compressors for cooling; therefore fairly consistent year-round markets can often be found.

An energy-from-waste plant would have to be operated to provide a secure, stable source of steam to meet the purchaser's requirements. The purchaser may require back-up capacity in case of interruption of supply, or the energy-from-waste plant may need duplicate components to improve continuity of supply. For example, the Charlottetown plant has two incinerators feeding one heat recovery unit.

If electricity is produced, the potential markets are increased; however, additional capital and operating costs will be incurred. If the electricity can be fed into the electrical grid, then problems about continuity of supply and seasonal nature of markets are greatly reduced. Energy-from-waste plants will require approval from the utility companies to interconnect with the Alberta grid system. Utility companies have generally resisted interconnection of small energy producers such as wind generators. This policy may be changing, following the Alberta Energy Resources Conservation Board's decision that permits a wind-powered generator to supply interruptible power to the grid. The price to be paid for the power is based largely upon the utility's replacement fuel cost rather than the marginal cost of production (ERCB 1984). This adversely affects the economics of electricity generation by small producers.

The Panel also was informed that some utility rate structures, that is, the formulae for charging customers for electricity, discouraged energy conservation and reduced the attractiveness of alternative energy sources (L. Slader 1986: pers. comm.). For example, a typical commercial rate structure assumes a minimum level of energy use. Reducing energy consumption below that level will not result in a saving for the customer. Another utility rate bases charges on the maximum demand during the previous twelve months. No savings are credited for any reduction in use below that maximum demand. These types of rate structures discourage a customer from conserving energy or seeking alternative energy sources such as energy from waste.

Recommendation:

> **The Public Utilities Board and Alberta Energy should conduct a review of utility rate structures with the intent of removing unnecessary barriers to the recovery and use of energy from waste.**

Incineration has been considered by several communities in Alberta either for their own wastes or to handle regional wastes (4, 10, 26, 47, 62, 90). In Wainwright, this option has been chosen. While the Panel feels that incineration of industrial or municipal wastes is less preferable than recycling, there will be circumstances where incineration will be the preferred option for local or regional authorities. If the decision is made to construct an incinerator, it is only sensible to consider incorporating energy recovery to help meet part of the capital and operating costs of incineration. Energy prices undoubtedly will rise in the future and the use of municipal solid waste as a fuel helps to conserve an increasingly valuable non-renewable resource. However, an energy-from-waste plant should be designed to handle only the residual waste stream, that which remains after usable materials have been removed for recycling. If materials can be reused or recycled, their intrinsic value is usually much greater than their value as a fuel.

Recommendation:

> **Alberta Environment should modify current incineration guidelines to require incineration proposals to include consideration of energy recovery in the design, siting, and operation of the facility.**

E. THE FOUR R's

Rethinking our approach to waste management and adopting the Four R's — reduce, reuse, recycle, and recover — as our guide will yield benefits in reduced waste disposal costs and improved environmental protection. These benefits are summarized in the following table:

Table 5. Benefits of the Four R's Approach

Compared to Landfill	Reduce	Reuse	Recycle	Recover
Lower Waste Collection Costs	X			
Lower Waste Transportation Costs	X			
Lower Waste Disposal Costs	X	X	X	
Saves Landfill Space	X	X	X	X
Reduces Environmental-Social Impacts of Waste Disposal	X	X	X	X
Improved Efficiency of Resource Use	X	X	X	X
Conserves Energy	X	X	X	X
Creates Job Opportunities		X	X	X
Produces New Marketable Commodities		X	X	X

IV. SOURCES OF RECYCLABLE MATERIALS

The Four R's approach allows us to divert materials from different points of the waste stream from point of manufacture to disposal. Since different parts of society produce waste streams in varying amounts and by different methods, opportunities to increase recycling are greater in some sectors than in others. This is particularly true for newspaper wastes from households, cardboard in the retail commercial sector, and fine paper from offices. This chapter identifies some sources where possibilities to increase recycling exist; Chapter VIII looks at possibilities to increase recycling of specific commodities.

A. HOUSEHOLDS

Alberta has a large urbanized population residing in single- or multiple-family dwellings. Generally, the contribution of multiple-family dwellings to housing stocks increases with city size. In 1981, about 32 percent of Albertans lived in 244,450 multiple-family units, and about 83 percent of these were renters. In contrast only 15 percent of single-family dwellings were occupied by renters (Alberta Treasury 1983). About 77 percent of the multiple-family units were located in Edmonton and Calgary, and these two cities accounted for about 52 percent of Alberta's population (Alberta Treasury 1983; Statistics Canada 1982). Urban Albertans, whether they are owners or renters, in single-family homes or multiple-family units, are a potential major source of recyclable materials.

The greatest volume of waste from households is paper and putrescibles like lawn clippings and kitchen wastes. There are also important amounts of non-beverage and container glass, ferrous metals (tin cans), mixed plastics, rubber (for example, tires), wood, and household chemicals.

Households of all types generate considerable volumes of newspaper. About 40 percent of the waste going down apartment waste chutes is newspaper (7). In many communities, there is a newspaper recycling system, usually operated by volunteers (3, 5, 24, 26, 27, 29, 33, 39, 42, 43, 48, 52, 61, 92, 130). Recycling programs diverted about 22,500 tonnes of old newspaper from the municipal waste stream in 1985 (92). Expansion of newspaper recycling has the potential to reduce considerably the contribution of household waste to landfills (125, 126).

Since success of recycling programs is related to how easy it is to recycle, differences in households become important considerations. Some of the differences and similarities between recycling in single- and multiple-family households are illustrated in the following table:

Table 6. Influence of Household Type on Recycling

	Single Family	Multiple Family
Storage space	adequate	limited
Waste stream	all types	little yard wastes
Waste handling	individual	mixed immediately with others' wastes
Collection	municipal	usually a commercial bulk hauler
Tenancy	owner dominated	renter dominated
Participants	family	owner, manager, residents
Turnover	lower turnover	higher turnover

In either type of housing, individual participation is an important characteristic of successful recycling of beverage containers and newspaper. Participation can be motivated by financial interest, by a concern for the environment, or by the opportunity to assist a charitable organization (33, 44, 61, 65). Recycling takes place at the individual level either through segregation of the waste, which facilitates collection, or through separation, storage, and delivery to a convenient place such as recycling bins or bottle depots.

The decision to recycle refundable beverage containers is easily made at the individual level, regardless of residence. Recycling newspapers is convenient in the single-family dwelling but less so in the multiple-family unit, since storage is required either in the apartment unit or in the building. A communal storage area involves more people and more storage space, which must meet fire regulation requirements.

Although recycling can be practiced most readily by the single-family householder because of available space and individual decision making, the small volume that the individual generates makes collection unattractive. On the other hand, the volumes potentially available from multiple units are attractive and more economically viable. However, organizing multiple units to recycle is more difficult because many players — householders, owners, superintendents, and fire inspectors — must be involved. If the multiple-family dwelling is rental rather than owned, there may be a reduced sense of community concern and responsibility when contrasted with single-family neighborhoods that may translate into lower participation rates in recycling programs.

But it can be argued that multiple-family dwellings represent a tremendous opportunity for significant progress in recycling programs. If the residents, manager, and owner of a large building decide to participate enthusiastically in a recycling program, a large amount of material would be available in one location. This would be attractive to haulers, brokers, and recycling agents. However, it should be noted that an important characteristic of successful household recycling programs is that they intercept the waste stream before wastes are mixed. This minimizes contamination of the recyclable commodity, minimizes labor costs, and facilitates collection (61, 71, 75, 83). Wastes in multiple-family dwellings are usually mixed very early in the disposal cycle.

Numerous possibilities exist to facilitate the development of recycling in multiple-family dwellings and neighborhoods. Municipal bylaws could require adequate space in buildings for the storage of recyclable materials. Information on the benefits of recycling could be made available to owners' or building managers' associations, including estimates of potential revenues that could be obtained by the building managers, owners, or residents. There is also the alternative of deriving some community benefits by putting attractive drop-off bins for recyclable materials in neighborhoods. If properly organized, the financial returns could be used to upgrade local recreational facilities or provide similar social benefits.

B. RETAIL COMMERCIAL BUSINESSES

The retail commercial sector has a wide variety of businesses and a diverse waste stream. It generates most wastes in reasonable quantity, with the possible exception of newspaper and fine papers. In this sector, another element increases in importance in the waste disposal/recycling equation: avoided disposal costs.

Garbage collection from commercial enterprises is usually contracted. The contract is based on weight, volume, or number of loads. Unlike the householder, a business could benefit directly from a reduction in the amount of waste produced. Businesses are thus provided with an incentive to separate and sell recyclables such as corrugated cardboard or scrap metal to a broker or recycler.

Many materials from the commercial sector currently are recycled, but recycling occurs primarily where the business produces enough valuable waste to justify collection systems. Cardboard is a good example — many retailers produce enough cardboard to justify purchase of their own baler, encouraged by a price of $50 per tonne and avoided disposal costs. There may be potential for several retailers in a commercial strip, retail building, or small mall to mutually benefit if a common baler were provided.

The commercial sector also generates beverage containers and container glass. Deposits on beverage containers ensure their return to the recycling systems, but this is not so for container glass.

Recyclables are collected from the retail commercial sector in two ways: separated at source where commodity prices warrant, and as bulk mixed disposal through commercial haulers. In some cases, it is profitable for the waste hauler to sort, or to contract out the sorting, of materials from "rich" loads. A rich load may have a high proportion of a desirable paper grade or recyclable metals. Incentives for increasing recovery of recyclable materials from commercial wastes are:

1) higher prices for recyclable commodities or higher disposal costs

2) improving the economies of scale of at-source collection systems through agreements among businesses to share equipment such as balers

3) separation of mixed wastes where enough rich waste is available to justify the sorting, often by hand.

C. OFFICES

Paper is a major byproduct of offices, and office paper is usually of the more valuable grades. Strong markets exist for computer printout paper, and white and colored ledger (92). Mixed paper is substantially discounted. The quality of waste paper is an important factor because of its direct effect on price (see Table 7).

Table 7. Representative Prices for Various Grades of Waste Paper

Grade	**Alberta *** **($/tonne)**	**Toronto **** **($/tonne)**
Computer printout	100	–
White ledger (writing paper)	80	155 – 165
Colored ledger	60	115 – 120
Repacked news (old newspaper)	35	35 – 40
Old corrugated (cardboard)	50	45 – 50
Mixed	5	10 – 25

* f.o.b. generator

** sorted, baled, delivered to dealer in 800 lb. bales

Sources: *Materials Recycling Markets*, November 1986 (Toronto prices) and Belkin Paper Stock, Edmonton (Alberta prices as of December 2, 1986)

There appears to be considerable opportunity to generate revenue and reduce disposal costs through the recycling of fine papers. Such recycling could be facilitated if offices had procurement policies that restricted purchases to a few grades of paper and if municipal bylaws required adequate space for recycling operations.

Attempts have been made to remove materials from office building waste streams, primarily various grades of paper and beverage containers. A Calgary disposal company has processed waste from office complexes to recover recyclable paper (7). Different grades of paper were hand-picked from the refuse as it moved along a conveyor belt, resulting in recovery of 50 to 70 percent of available paper. Beverage cans were also retrieved.

D. INDUSTRY

The industrial sector is both a producer and a user of waste products. Many industrial operations generate byproducts that can be used either by the producer or by another industry. For example, at a steel smelter, reject billets are recycled internally as feedstock for a later melt. Defective plastic products and trimmings usually are returned to the beginning of the production line for reuse. Steel fabricators collect their scrap metal and return it (often through a dealer) to manufacturers for reuse. Glass cullet from the beverage and container industry can be used in the production of new containers, fiberglass, and glass beads. Used oil from the automotive service industry is sold to the re-refiners for use as a feedstock. Applied Polymer Products of Edmonton is using recycled PET bottles as a feedstock in the production of extruded plastic products. Residue from the sawlog industry can be used in the production of fiberboard.

As in the case of office wastes, attempts have been made to sort mixed industrial wastes. Tipping fees may be reduced for loads rich in recoverable materials, depending upon concentration and degree of cleanliness. This system is used by a private waste-handling company (GSX Ltd.) at transfer stations in British Columbia, Oregon, and Washington.

Recycling of industrial wastes is driven by market forces, including avoided disposal costs. If wastes cannot be recycled, they must be disposed of, often through contracting a hauler to take them to a landfill. In the near future, hazardous wastes will have to be transported to the special waste management facility at Swan Hills for proper disposal. The principles of the Four R's of waste management can be productively applied to the industrial sector to increase recycling of industrial wastes, for example:

1) reduce inputs through the use of recyclable materials; for example, the use of cullet in a glass plant reduces energy and virgin materials requirements

2) reuse scrap materials such as scrap iron in a steel mill or trimmings in a paper mill

3) recycle industrial wastes by separating and storing them in homogeneous categories so they are attractive to the recycler

4) recover energy from waste materials, as is done with coke in the production of synthetic oil.

A major barrier to recycling of industrial wastes is lack of information such as the kind, quality, and location of materials available. This issue is discussed in detail in Section VII B.

E. LANDFILLS

Landfills frequently provide opportunities to segregate materials. Many landfills have separate locations or storage for used lubricating oils, metals (particularly white goods), tires, and combustibles.

Many comments were made at the hearings about salvaging at landfills (19, 23, 61, 64, 67, 83, 86, 87, 90, 91, 103, 104, 110, 111, 125). While scavenging – the uncontrolled recovery of materials – is prohibited by the Alberta Public Health Act, salvaging – the controlled recovery of materials – is not. However, most landfills are not organized to allow salvaging and hence this activity is discouraged. Other landfills have areas set aside for recyclable materials and salvaging is permitted. It was suggested that landfills be designed to encourage salvaging, perhaps through the use of drop-off bins for recyclables, the development of a gleaners' market or ''free store'' at the entrance to the landfill, or through setting materials aside in designated areas (61, 64, 76, 83, 86, 91, 103, 104, 125).

Recommendation:

> **Alberta Community and Occupational Health and Alberta Environment should develop guidelines to facilitate and encourage salvaging of resources from municipal landfills.**

Implementation of this recommendation would help to make recyclable resources more readily available, extend landfill life, and may generate revenue to partially offset costs of operating the landfill.

V. COLLECTING RECYCLABLE MATERIALS

A. SORTING: BEFORE OR AFTER COLLECTION?

There are two basic strategies for acquiring recyclable materials: at-source separation and processing mixed refuse. At-source separation refers to programs that divert a recyclable material from the waste stream before it becomes mixed with other materials. Many industrial wastes can be recycled because they have been kept aside for that purpose. Examples of at-source separation of domestic wastes include paper drives, bottle depots, curbside collection, and bins for used clothing. Alternatively, municipal solid waste can be processed to recover individual components, such as metal, cardboard, or organics. Large central processing facilities are needed for this.

The characteristics of these two collection strategies are discussed below. Each strategy has advantages and disadvantages and both may find a place in Alberta's mix of waste management strategies. However, the Panel is convinced that the advantages of at-source separation make this strategy much more attractive.

At-Source Separation	**Central Processing of Mixed Waste**
Greater responsibility placed on waste generator	Little responsibility placed on waste generator
Often requires promotion	Little promotion needed
Low tech	More technology involved
Moderate capital investment	High capital cost
Labor intensive	Limited labor
Large volunteer component	Mostly paid labor
High-quality product	Low-quality product
Flexible	Relatively inflexible
Good track record	Questionable track record

At-source separation relies on the participation of the waste generator and therefore requires extensive promotion and education. The generator must be aware of the benefits of recycling if he or she is going to make the additional effort to segregate recyclable materials. Direct involvement of the waste generator is beneficial because it educates the generator about the quantity and nature of waste being produced.

Processing mixed refuse can be an "add on" to existing waste management systems. It requires a decision by the waste managers to implement the new system. The waste generator is not involved – the refuse is collected as usual, but delivered to a central processing facility rather than a transfer station or a landfill. This processing facility usually houses complex assembly-line technology and requires substantial capital investment.

Most at-source separation programs are low tech, labor-intensive ventures. Much of the labor for such things as sorting and delivery of the material to a depot is supplied by the waste generator. In many instances, volunteer labor may be involved in collection and processing. Because the materials are kept from mixing with the regular waste stream, little additional handling is required to prepare the material for its market destination. Furthermore, segregated materials are more pleasant to work with than mixed refuse. The recovered material is generally of high quality and therefore more easily marketed. It can often be used directly as a feedstock by the end user.

At-source separation programs usually focus on a few materials, such as newspaper, beverage containers, or used oil. Many different programs may be needed to address the great variety of recyclable materials found in our waste stream. However, programs can be tailored to the target commodity and this improves efficiency and flexibility. Curbside collection can include many different materials.

Mixed waste facilities usually process the entire waste stream with a fixed sequence of processes. Several materials may be recovered, but the degree of contamination can be substantial. Product descriptions such as "glass-rich" and "paper-rich fractions" indicate the failure to extract clean materials. Markets for the large quantities of this low-grade product may be difficult to develop.

Perhaps the most attractive characteristic of at-source separation is its growing popularity and general success. People are willing to separate their wastes into recyclable components (51). Alberta's bottle depots have been well received by the public and return rates are high. More and more municipalities throughout North America are offering curbside collection of recyclables. The track record of centralized municipal solid waste processing facilities in the North American context is not as good. This is in spite of substantial capital investments in high-tech facilities and a long period of government-supported operation, such as for the Ontario Centre for Resource Recovery in Downsview, Ontario.

The Panel views at-source separation as the better strategy for materials reuse and recycling. However, refuse from some sources is relatively homogeneous and, if kept separate from the general waste stream, may be processed without much difficulty. As discussed in the previous chapter, waste from office complexes is usually rich in fine paper, and cardboard often dominates the refuse from retail outlets. These special waste streams can be processed to retrieve the cardboard or paper.

B. STORAGE

Storage space is an important requirement for recycling, especially if at-source separation is involved. Perhaps the greatest commitment the recycler must make is providing adequate space to store the recyclables until the next collection day, or until enough material has accumulated to warrant a trip to the depot.

As noted in Chapter IV, storage space in single-family dwellings is usually adequate for the small amounts of materials that are recycled. For multi-family dwellings, recycling is much less convenient. Space in the individual units is usually at a premium and a common room or space is rarely available for storage of recyclables. Lack of storage space can also be a problem in office buildings and shopping malls, where there is good potential for recycling paper and cardboard, respectively. These facilities are not designed with recycling in mind and the lack of adequate storage space is a barrier to recycling.

The design of multi-family complexes, office buildings, and commercial buildings is governed by provincial building codes and municipal bylaws. Currently, municipal bylaws specify the amount of space that must be provided to accommodate the storage and collection of refuse. The Panel believes that similar allowances should be made to accommodate the storage of recyclables. Such provisions would greatly facilitate recycling from these potentially large sources of recyclable materials, and may not require much additional space. Building management could benefit from the revenues from the recyclables as well as from reduced waste removal needs.

Recommendation:

> **Alberta Environment, in co-operation with Alberta Municipal Affairs, should develop a municipal bylaw provision that would provide for adequate safe and convenient storage space for recyclable materials in new multi-family dwellings, office buildings, and shopping malls.**

C. METHODS OF COLLECTION

Several methods for collecting recyclables are described in *A Social Perspective of Recycling in Alberta*, one of the background reports prepared for the public hearings (Free 1986). During the hearings and subsequent tours, the Panel observed several collection programs and gained further insights.

Drop-off Depots

Newspapers, used clothing, and used oil are sometimes collected using unsupervised drop-off depots. Large containers are placed at central community locations, such as shopping centers, church parking lots, community centers, and so on. People can drop off material at their convenience.

Several people recommended drop-off depots as a means of collecting paper, glass, metal, and plastic (37, 91, 128, 132). In some countries, this is a standard practice. In Germany, elegant neighborhood containers are used for dropping off paper, bottles, and cans (100). In California, igloo-shaped fiberglass bins are being used to collect bottles (*Resource Recycling* 1986c) and can be used to collect other recyclables. Reverse vending machines that pay out refunds for beverage cans are also gaining popularity in the U.S.A.

The Panel saw a number of different containers being used in Alberta. In Hanna, an old grain bin was used to store newspapers; in Oyen, a transport trailer stood ready for people to leave bundled newspaper. More typical containers were large metal bins, wooden crates, and, for used oil, storage tanks. In most cases, collection bins are supplied by recycling companies, purchased with government grants, or donated by local residents. Scrap metal dealers leave bins at industrial sites for collection of metal scrap. Alberta companies involved in used paper collection will provide charitable groups with bins. The charitable groups may have to guarantee a minimum volume of material or pay rental or collection charges for the bin. Alberta Environment has provided resource recovery grants to municipalities and non-profit groups to cover the cost of purchasing trailers, bins, and storage tanks.

Drop-off depots are often sponsored by charitable organizations, which provide volunteer labor for stacking and sorting the material. Often the work of a few highly motivated individuals keeps the projects going. The Medicine Hat Christian School has a program called Adopt-a-Bin, whereby families are encouraged to assume responsibility for a collection bin (24). This practice gets more people involved in recycling and reduces the workload for the individual volunteers.

Drop-off depots can be efficient means for collecting recyclable commodities. The main advantage is their low operational costs. However, because they are passive collectors, advertising is needed to promote their use.

Supervised Depots

In contrast to unattended collection bins, many depots are supervised during their hours of operation. Personnel accept materials from the public, pay customers for their recyclables, and sort or process the material. The offer of money for recyclables provides an effective incentive for attracting the public. Depot personnel can monitor the incoming material and reduce the degree of contamination.

In Alberta, beverage containers are accepted at supervised bottle depots where prescribed refunds are given. In other parts of North America, similar forms of recycling buy-back centers are found. Sometimes the payout is based on the intrinsic value of the recyclable material. This practice has been introduced at some Alberta universal depots where newspaper is purchased for a few cents per kilogram. The Alberta Bottle Depot Association has indicated that it would be willing to participate in the recycling of other materials (57). The Panel encourages the expansion of these private businesses into new recycling programs.

Curbside Collection

Curbside collection of recyclable materials makes recycling very convenient. Residents simply segregate and store the materials and set them out at curbside on collection days. In many curbside programs, residents are supplied with a container in which to store the recyclables. The materials are collected and delivered to a central depot or directly to market by a common service, often associated with refuse collection.

Curbside collection of recyclables is gaining popularity throughout North America. The Panel observed curbside collection programs in Mississauga, Halton Region, and Niagara Falls, Ontario. These services were operated by very different organizations. The Mississauga operation was run by a subsidiary of a large multi-national waste disposal firm. The Halton program was run by a small family-owned company, and the Niagara service was operated in conjunction with an adult rehabilitation program. The Panel was impressed by the apparent efficiency and success of all three systems. They illustrate the "pioneering" nature of curbside collection; there is no firmly established formula or system, but an opportunity to develop systems tailored to local needs and initiatives.

The flexibility of curbside collection is also reflected in the range of materials collected. Some programs collect only one material, such as newspapers. Multi-material collection programs commonly collect newspapers, glass bottles, and cans. The Panel has also heard instances of plastic, lube oil, and grass clippings being collected at curbside.

Some curbside collection programs have been established in Alberta. In certain neighborhoods of Calgary, a private company operates a curbside collection of household newspaper. Foothills Conservation and Recycling Ltd. collects newspaper from about 50,000 homes (3). Plastic bags are provided to residents for this monthly collection. Charitable community groups promote the collection in return for a percentage of the revenues generated. Fifty to ninety percent of the residents participate in this program, through which 250 to 300 tonnes of paper are collected each month (3). The company employs five or six people for this recycling program.

In October, 1986, the City of Edmonton and Alberta Environment initiated a one-year pilot project for curbside collection of recyclables. Approximately 1,500 homes in three residential areas were asked to segregate newspaper, glass, and household metal from their garbage for recycling. Each participating household was provided with a plastic box to store the materials. Modified City garbage trucks are being used to collect the materials.

This pilot project has been well received by Edmonton residents. About 70 percent of the households in the study areas are participating. The quantities of materials collected by the end of 1986 include 47.9 tonnes of paper, 8.8 tonnes of glass, and 5.6 tonnes of metal (Z. Figol 1987: pers. comm.). Should this apparent success continue, the Panel would like to see this curbside collection project continued as a regular service and expanded to other neighborhoods in Edmonton. This service could be contracted out to the private sector or continued as a municipal service.

The Panel noted that much of the glass and metal fraction collected consisted of beverage containers that could have been returned for a deposit refund. This material could help reduce the cost of the program.

This service encourages the public to view waste materials as potential resources. Such a change in attitude would benefit all recycling programs. Discontinuance of this popular service after the residents have become accustomed to it would reflect poorly on recycling and imperil future programs.

Recommendation:

> **If the City of Edmonton's curbside collection project continues to be successful, it should be continued as a regular service and gradually expanded to cover the entire city.**

The Panel sees many advantages to curbside collection. The quality of the materials collected is generally high. Its convenience attracts high participation rates and gets people into the habit of recycling. Once established, the program can be adjusted to accommodate other materials if desired. Participants gain a better understanding of the amount and nature of the waste they produce and this can lead to actions to reduce personal waste generation.

As discussed in Chapter II, some municipalities, such as Edmonton and Calgary, are subsidizing garbage collection from general revenues. The Panel feels that this inhibits recycling by shielding residents from the actual cost of waste collection. The Panel has recommended that residents pay the actual cost of this service, but if these municipalities choose to continue this subsidy, they should provide equivalent subsidies for curbside collection of recyclables. Such subsidies would remove a hidden incentive to throw out recyclable materials and place recycling and waste collection on equal footing.

Recommendation:

> **The provincial government should pressure those municipalities that subsidize waste collection to provide equivalent subsidies for collection of recyclables.**

Many calls for diversion credits were made at the public hearings, and suggested elsewhere. The Panel appreciates the principle behind the suggestion for diversion credits, but we feel that they would not be particularly effective in the current Alberta situation. For one thing, the currently estimated cost of landfilling is so low that diversion credits would not provide much assistance to recycling. After the experience of siting the next generation of landfills has been incorporated, and the true and full cost of landfilling has been calculated, the impact of diversion credits could be re-evaluated.

In the meantime, the Panel believes that the principle of the above recommendation should apply. If a municipality wishes to subsidize the collection and landfilling of garbage, it should be prepared to provide an equivalent subsidy to recycling. It is the Panel's belief that, if recycling and garbage collection are treated equally, recycling will be able to expand its share of waste materials substantially, with no extraordinary government assistance.

Collection Drives

Collection drives constitute a form of curbside collection that is operated largely by charitable groups, often on regular basis. Although paper and bottle drives are common in Alberta, very few comments on this method of collection were received at the public hearings.

Two main commodities are collected in this manner: newspapers and beverage containers. Revenues from paper drives are based on the intrinsic value of the paper. Paper drives have been particularly susceptible to fluctuations in the market price. Revenues from bottle drives are based on the refund of prescribed deposits and are therefore independent of market fluctuations.

Where regular curbside collections are established, the potential for drives may decrease. Ready access to bottle depots is another competing factor. Nevertheless, many communities will not receive regular curbside collection and drives will continue to find a place among recycling schemes in Alberta.

Processing Mixed Refuse

In many countries, municipal solid waste is processed in central facilities. A large plant near Amsterdam recycles most of the waste stream from that city (79). In Italy, a plant has been processing the refuse from 15 municipalities since 1974 (58). Often, the bulk of the waste is converted into compost or refuse-derived fuel. Other materials, such as glass, paper, and ferrous metals, may also be recovered.

The success of large processing plants in North America is variable. More and more American cities are being served by energy-from-waste plants. Many of these plants are using refuse-derived fuel from waste processing plants. However, central processing for recovering specific materials has been less successful. The Panel visited the Ontario Resource Recovery Centre in Downsview, Ontario. At this demonstration plant, a portion of Toronto's waste stream was processed into a variety of products, including cardboard, refuse-derived fuel, glass, ferrous metals, and compost. This plant was designed more for demonstration purposes than for operational efficiency. As well, marketing the low-quality products proved to be difficult. This facility has since been closed. The City of Edmonton tried an experiment in which they recovered ferrous metals from municipal solid waste, but found that metal dealers were not interested in the scrap because it was contaminated and better quality scrap was available elsewhere (City of Edmonton 1978).

Central processing of municipal solid waste is still an option being considered by some municipalities. In Montreal, a major facility is being constructed to process city refuse. Some people attending the hearings favored forms of central processing for Alberta (7, 58, 59, 70, 114). A proposal was made to study the feasibility of building a facility near the village of Ryley to process the organic portion of Edmonton's municipal solid waste into compost (70).

In some instances, small-scale processing of refuse may be feasible. It was suggested that processing mixed office waste to recover paper was more efficient than having office workers separate paper at their work stations (7). The differences between the two situations are:

Workstation Sorting	Waste Stream Sorting
Staff time spent on sorting is limited and costly	Sorting can be undertaken by a building manager or put out to bid
Revenues flow to other than the individual	Revenues can be directed to building managers
Required storage systems are seldom designed into buildings	Sorting and storage facility required, but suitable space may not be available
Potential to achieve high recovery rates for specific grades of paper	Recovery rates may be less, but more grades of paper are likely to be recovered.

Although the Panel sees greater advantages in at-source separation, opportunities to recover valuable materials from the mixed waste stream should be exploited, particularly from high-grade waste streams such as from office buildings, before the waste is mixed with other municipal refuse.

D. THE ROLE OF PRIVATE AND VOLUNTEER SECTORS

Each region of the province has its own economic base and mix of waste streams. The waste streams will vary from place to place depending upon the particular situation. Potentially recyclable materials can originate from many places such as: households, commercial facilities, agricultural industries, forest industries, office complexes, industrial processors, and construction operations.

Some waste materials have intrinsic value, while others only have value after sizeable homogeneous amounts have been accumulated. The amount and value of materials has considerable influence on the methods used for collecting, sorting, and processing, and upon who does it.

The price paid for a resource can be determined by the market or, in the case of beverage containers, by legislation. In the latter case, part of the collection system, that is, depots, can also be established by legislation. Several patterns can be seen in collection systems for resources of increasing value.

When waste commodities become valuable, there is a tendency for the involvement of volunteers to decrease and for the involvement of the private sector to increase. Low-price commodities require a free, or very cheap, labor force to bring the commodity to the industry or market that uses the material. Concurrent with low commodity prices is the need for carefully organized collection systems. Successful volunteer programs require clear direction to participants and a sense of camaraderie without the rigid discipline of many workplaces. The program must also be reasonably efficient and productive, for although volunteer labor is cheap, it is not free. Volunteer workforces tend to disappear if there is a perception that little is being accomplished in exchange for the efforts expended.

When prices increase, so do business opportunities and the private sector becomes increasingly involved, noticeably at the collection level. With higher prices it is also important to be well organized, as mistakes can cause costs — particularly labor costs — to escalate. In the recycling business, enterprise, efficiency, and productivity considerations dominate just as in all other profit-driven enterprises.

However, price is not directly related to the need for a high-quality commodity. Low-price materials must also be of high quality; otherwise they drop even further in value and become uneconomic to collect. Higher priced material can tolerate some contamination at source as the product's price justifies some sorting and processing.

The Dilemma of Price

For practical purposes, individuals and organized volunteers can only be involved in the collection and, at times, preliminary sorting of materials. Recyclable materials become a resource when they arrive at the plant gate.

What, then, is the role of the individual, the organized volunteers, and the private sector before recyclable materials reach the plant gate? It is related to the price of the material and the quantity required for it to be marketable. The more a waste material is worth, the less likely it is to be discarded, or if discarded, the more likely it is to be recycled. High prices bring the efficiency of the private sector into play, leading to well-organized collection systems. Concurrently, high prices squeeze out the charitable organization that sells recyclable materials to fund its operations.

Charitable organizations are able to use low-value recyclable materials as a funding source because they can subsidize collection, sorting, and, possibly, transportation, through the use of volunteers. The volunteer sector usually concentrates on old newspapers and deposit containers. However, there is a danger that the volunteer sector would disappear if the price paid for old newspapers or deposit containers increased substantially.

For example, a one-dollar deposit on a beverage container would likely result in:

1) very high return rates from the initial purchaser
2) minimal appearance of deposit containers in the municipal waste stream
3) a substantive decrease in containers available for neighborhood bottle drives.

The situation would be slightly different with large increases in the price paid for old newspaper. This is because old newspaper still would need to be sold in large lots, consisting of several tonnes. Hence, saving of newspapers by individuals would be impractical due to storage and transportation difficulties. The probable result of substantially higher prices for old newspaper would be:

1) private sector involvement in the collection system in competition with volunteers and charitable organizations
2) reduced appearance in the municipal waste stream.

So, higher prices are a mixed blessing. They are beneficial to the environment and to the budgets of municipal waste managers, yet may result in a need for new funding sources for volunteer organizations.

The volunteer sector can therefore be considered an incubator or transition stage in the development of recycling. It requires a price for the waste material that will generate sufficient funds for it to be attractive for a service club or non-profit sponsor to think it worthwhile to arrange the volunteers and undertake the complex organization necessary to make the project feasible.

When, or if, the returns from recycling become so high that the private sector is willing to establish facilities, arrange for collection, and pay market wages to the work force, the volunteer sector is essentially replaced. This has occurred in the metal collection industry, where the total system is essentially in private hands. There might be the occasional small-volume, low-value product, such as tin cans, where the volunteer is still essential to make collection and delivery feasible, but for the bulk of ferrous and non-ferrous metals the collection, storage, and delivery systems are privately run.

There is a long and slow transition period from a low-value recycled commodity to one of high value. The rate and pace will depend on the market for the product (both in volume and value), the density and collectability of the waste, and the transportation costs to the user. Ontario seems to be just at the stage of transition from a volunteer recycling sector to a private recycling sector for used newspaper. Because of the density of households and the strong and stable market, with a major de-inking plant close to the center of gravity of population, the used newspaper recycling sector is moving from one that relied entirely on paper drives and volunteer collections to one where some private recyclers, both small family operations and large waste haulers, are finding recycling attractive in densely populated Southern Ontario. This has been helped by provincial assistance in the form of diversion credits available for a limited period of time and the willingness of certain Ontario municipalities to contribute from their general revenue to the support of curbside collection.

The Panel has been impressed with the effectiveness of the Department of Environment's Resource Recovery Grant Program. This is a low-cost program, only $150,000 per year, that provides small grants to various volunteer organizations. These grants, ranging from $8,000 to $10,000, encourage them to develop recycling programs. The grants are tailored to the individual local situation; they can be used to purchase a baler, an oil tank, a trailer, a storage bin, or whatever is necessary to get a particular volunteer project off the ground. As such, the small expenditure often removes the barrier to the application of large amounts of valuable volunteer labor and the production of significant amounts of recycled materials. This program is an example of a very rare beast, a low-cost, highly developed, people-oriented, beneficial government program.

Recommendation:

> **The Alberta Environment Resource Recovery Grant Program should be continued with increased funding so that volunteer recycling efforts can be provided the essential boost that they often need in the form of capital equipment to get recycling projects started.**

VI. THE PRESENT RECYCLING INDUSTRY IN ALBERTA

Earlier chapters presented information about some of the neglected social and economic costs of our present use of landfilling as the preferred waste disposal method. The case was made that a change in attitude was necessary in order to reduce the cost increases that continued reliance on landfilling, as virtually the only disposal method, would bring. Information contained in *Resource Recycling in Alberta* (Lilley 1985b), as well as the information collected during the public hearings, indicates that Albertans have already taken substantial steps toward recycling. These activities have led to the development of industries based on the recycling of recovered materials. Because recycling is not recognized as an industry in its own right, and because of concerns about confidentiality, it is very difficult to obtain even a rough estimate of the contribution that recycling currently makes to the economy of Alberta.

According to Statistics Canada (1984a), 278 companies in Alberta are involved in the wholesale trade of scrap and waste materials. These companies include auto wreckers and dealers in paper, glass, metals, plastics, textiles, and used industrial materials. The total value of this wholesale scrap trade in 1984, based on reports filed by the companies, was over $77 million.

Probably the largest industry in Alberta using recycled materials is that based on scrap metals. This industry comprises a vast network of independent scrap metal collectors and processors scattered throughout the rural and urban areas of the province. These collectors may also go outside of the province both to purchase and sell scrap. Steel scrap is processed by major steel manufacturers in Calgary and Edmonton. As well, there are a number of foundries in operation. Most non-ferrous scrap is sold to buyers outside of the province.

One brief to the hearings stated that 13 Alberta members of the Canadian Association of Recycling Industries were involved in scrap metal processing. These would be mainly the larger companies and those actually processing scrap. These companies employ approximately 220 people (13). As well, there are a number of companies that are not members of CARI that collect and deal in scrap but do not process metals. A scan of the telephone books for the major municipalities in Alberta reveals more than 50 companies dealing in scrap metals – 23 listings for Edmonton, 20 for Calgary, four companies in the Grande Prairie area, four in Red Deer, two in Lethbridge, and one in Medicine Hat. Many small collectors and dealers in scrap would not be listed.

According to Dvorkin (1986: pers. comm.) the value of scrap sold to the steel mills and foundries in Alberta is about $35 million each year. This estimate is based on total ferrous scrap purchases in Alberta of about 500,000 tonnes per year at an average price of $70 per tonne at the mill. Stelco, the largest steel producer in Alberta, employs about 800 people. In 1985, the company purchased approximately 260,000 tons of scrap to produce steel for the western Canadian market and semi-finished steel for Stelco plants in eastern Canada (W.C. Wordie 1987: pers. comm.). The other steel mill, Western Canada Steel in Calgary, employs 170 people and purchases about 90,000 tons of scrap annually (D. Lamont 1987: pers. comm.).

The foundries in Alberta consume between 10 and 20 percent of the ferrous scrap used in the province (Dvorkin 1986: pers. comm.). In 1984, there were nine iron foundries in Alberta. These foundries employed 403 people, paid almost $9.5 million in wages, spent almost $9 million on materials and supplies excluding fuel and electricity, and shipped $34.5 million worth of products (Statistics Canada 1984b). The Panel estimates the value of the combined output of the Alberta steel mills and foundries to be almost $150 million per year.

As well, a major portion of scrap metal industry is collection and processing of non-ferrous metals. Most of this material is sold to dealers outside of the province. Dvorkin (1986: pers. comm.) estimates that the value of non-ferrous scrap would be in the range of $25 to $30 million per year.

Paper recycling supports another group of industries in the province. In Alberta, recycled paper is collected mainly for use in manufacturing asphalt building materials. According to Statistics Canada, three companies in Alberta manufacture asphalt roofing (Statistics Canada 1983). In 1983, these companies employed 263 people, paid salaries of over $7 million and manufactured almost $23 million worth of product. Recycled paper is used along with wood fiber to make the "felt" base for tar paper and shingles, although only two of the plants manufacture paper in Alberta; the third brings in felt from a branch plant in Manitoba. The effect of using recycled fiber on the cost of manufacturing felt is not known, but Canada-wide data indicate that the cost of the felt in asphalt industry products is about 25 percent of the total costs. Using this information, it can be calculated that in 1983 approximately $9 million worth of untreated felt went into manufactured product in Alberta.

The secondary fiber used in the asphalt roofing and insulation industries is supplied by two processors of recycled paper. One of these, I.G. Paper Recycling of Calgary, paid approximately $1.5 million for the paper it purchased in 1986. The company has about eight full-time and 10 part-time employees (M. Dupuis 1987: pers. comm.). Allied Paper Savers of Edmonton employs 14 people full-time and part-time (A. Ballachay 1987: pers. comm.). Information about the value of their purchases of paper was not available, but the Panel estimates the purchases to be at least $750,000 per year. The other major paper processor in Alberta, Belkin Paper Stock, purchases paper for use in its boxboard plant in British Columbia. Information is not available about their staff requirements, nor directly about the value of their recycled paper. However, based on information presented at the hearings related to the amount of different grades of paper purchased in 1986 and the expected purchase price for the different grades, a rough estimate can be made: in 1986, Belkin Paper Stock spent more than $1.5 million purchasing paper in Alberta. In total, therefore, at least $3 million is spent annually in Alberta to purchase used paper.

The two oil re-refineries in Alberta recover and reprocess about one fifth of the lubricating oil sold each year. Turbo in Edmonton employs 20 people directly in its re-refining operation and produces about $3 million (wholesale price) in products each year (D. Cameron 1986: pers. comm.). Hub Oil in Calgary also employs 20 people and annually produces approximately $2 million in product (A. Shimbashi 1986: pers. comm.). In addition to the people employed directly in the re-refining operations, there are those who collect and transport the 25 million litres of used oil re-refined each year.

The more than 200 universal depots in Alberta employ more than 700 people. Many of the depots are associated with training centers for the handicapped and provide education and work experience for handicapped adults. In addition, 150 employees of Alberta Brewers' Agents Limited and the brewers buy, warehouse, sort, transport, and dispose of beer containers (A. Renaud 1987: pers. comm.).

Glass collected through these depots is used by two major manufacturing industries in Alberta. Domglas in Redcliff is the largest secondary industry employer on the Prairies. The company employs about 525 people in the manufacture of glass containers and spends close to $1 million each year on cullet (18). Canasphere Industries in Calgary uses cullet to manufacture glass beads. This company spends about $600,000 each year to buy cullet and produces $2.5 million in products. The company employs 10 people (B. Knott 1987: pers. comm.).

Aluminum containers are baled and sold. The scrap value of the aluminum beer containers, for example, was approximately $1.5 million in 1986 (A. Renaud 1987: pers. comm.).

Plastic beverage containers collected through the universal depot system are processed into a variety of products by Applied Polymer Products Ltd. in Edmonton. This company is expanding rapidly and expects to employ 180 people by the end of 1987 and produce about $6 million in plastic products using recycled post-consumer plastics (C. Ronden 1987: pers. comm).

In addition to these few industries, there is a network of individuals and small companies involved secondarily in recycling. These people include those involved in the collection and transportation of recycled materials, the manufacture of equipment and supplies, scrap processors, scrap dealers, non-profit organizations, and individuals who deal in secondhand goods.

In summary, while it is not possible to place an exact figure on the value of recycling to Alberta's economy, the composite estimates indicate that, in total, as many as 3,500 people may be employed in industries related to the collecting, transporting, and processing of recycled materials. The value of the recycled material and products manufactured in Alberta that contain recycled material could amount to about $300 million. In the absence of these industries, there would be an even greater utilization of Alberta's landfills to accommodate the diverted metals, glass, paper, and oil at greater disposal costs and with the accompanying loss of jobs and product values. It is on this already considerable resource recovery industry that future expansion of recycling will be based.

Table 8. The Present Recycling Industry in Alberta

	Number of Businesses	Number of Employees	Value of Material Purchased ($ Millions)	Value of Products ($ Millions)
Wholesale Trade	278	–	–	77
Universal Depots and Beer Bottle Depots	225+	850+	–	–
Steel				
Mills and Foundries	11	1,300+	35	150
Scrap Dealers and Processors	50+	220+	–	35
Paper				
Building Materials	3	263	–	23
Used Paper Purchasers	3	50–70	3	–
Glass				
Bead Manufacturer	1	10	0.6	2.5
Container Manufacturer	1	525	1	–
Oil				
Post-Consumer	2	40	–	5
Plastics	1	180	–	6

Source: Information gathered from a variety of sources. It is incomplete and fragmented because recycling is not considered to be an industry in its own right, with statistics collected separately. See text for details.

VII. FACILITATING RECYCLING IN ALBERTA

A. ALBERTA GOVERNMENT PROGRAMS

1. RESOURCE RECOVERY GRANT PROGRAM

Alberta Environment has encouraged recycling projects through its Resource Recovery Grant Program (Alberta Environment 1986). Grants are available to non-profit organizations and municipalities to offset the costs of establishing collection of recyclable materials. The grants are for capital components of a project and commonly cover equipment such as trailers for paper collection, underground storage tanks for used oil, sheds for storage of collected materials, pumps, balers, and pallet-handling equipment. Operating expenses must be borne by the community or by the organization. The project should generate sufficient revenue to cover future operating costs and depreciation to enable the project to continue on a long-term basis without further grants from the department.

Since its inception in 1977, the program has provided a total of $705,681 to support 112 projects collecting paper, oil, or glass. The annual level of funding available has been increasing gradually and in 1986 slightly more than $150,000 was available. The average grant per project was between $8,000 and $10,000. Assisted by the grant program, many non-profit organizations in Alberta are now involved in recycling. Considering the modest level of support this program offers to recycling, exceptional results have been achieved. But the success of the program is also creating difficulties. As projects grow in size and complexity, the size of requests for grants also increases (Alberta Environment 1986).

In Section II D, the Panel recommended that Alberta Environment phase out its capital assistance program for the development of regional landfills and that the funds freed up by this move be used as an incentive for recycling. If implemented, this recommendation could greatly increase the level of funding available to the Resource Recovery Grant Program. However, the increased availability of funding should not be seen as an opportunity to support all recycling ideas without restriction. Recycling proposals should be subject to restrictions similar to those which are applied informally to recycling proposals at present. The Panel suggests the following criteria for recycling grants:

1) Assistance should be given once, to meet front-end costs while techniques are perfected and markets developed.

2) Funding should be provided as capital grants.

3) If an enterprise does not appear to be capable of being self-supporting within a limited time span, perhaps three years, it should not be supported.

The increased level of grant funding would also allow Alberta Environment to expand the program to all aspects of recycling, including private, profit-oriented businesses.

Recommendation:

Alberta Environment should expand the Resource Recovery Grant Program to include recycling businesses as well as non-profit recycling projects.

The Panel wishes to ensure that the role of the volunteer recycler and non-profit organizations in recycling continues to be recognized and supported. This could be done by dividing the program into components and earmarking a certain portion of the available grants for non-profit organizations, while at the same time expanding the overall grant program to make funding available for recycling businesses.

It should be noted that the Panel does not believe this assistance should be available to large waste management firms or major recyclers. Elsewhere in the report, increased access to the Accelerated Capital Cost Program, as well as improved availability of business development programs at the federal and provincial level, are suggested, which would be more attractive to large, capital-intensive businesses. The Resource Recovery Grant Program would be more suitable for small, local businesses, of under 10 employees with very small capitalization.

2. BEVERAGE CONTAINER ACT

History of the Act

Intended primarily as a litter control measure, the Beverage Container Act was passed in April, 1971, and required retailers to accept the return of any glass or metal beverage container and pay the minimum deposit set by the regulations. The manufacturer was required to pick up containers from the retailers. Beverages included under the Act were carbonated and non-carbonated soft drinks, but non-carbonated beverages and their containers and containers larger than 40 oz. were excluded in the initial regulations passed in November of 1971. Plastic containers were not yet on the market and juices, wine, and spirits were not included under the initial Act.

The deposit was set at a minimum of two cents. The regulations included provisions for establishment of depots for the purpose of collecting containers and giving refunds (A.R. 327/71). Approval for a depot was required from the Environment Minister.

The Act was amended in June, 1972 (S.A. 1972 c.16) to include liquor and wine bottles and to allow for the establishment by the retailer or beverage manufacturer of "universal" depots for the collection of all containers.

Regulations in the same year (A.R. 353/72) continued the exemption on uncarbonated soft drinks, exempted containers of less than 3 oz. and over 60 oz., and exempted beer and beer containers. Deposits were set at a two cent minimum on soft drink containers and a five cent minimum for liquor and wine containers. The universal depot operator was required to sort refillable containers according to manufacturer and non-refillable containers by material — glass or metal. A handling charge, payable to the depot operator, was set for each container type.

In 1976, the regulations were amended to require universal depot operators to sort bottles by color (A.R. 280/76).

New deposit levels and handling charges were set in 1978 (A.R. 320/78) but changed in September, reducing the deposit on smaller soft drink containers from 10 cents to five cents (A.R. 345/78). Regulations in 1979 changed the handling charges (A.R. 65/79).

In 1980, fruit and vegetable juices sold in metal containers were brought under the Act and its regulations (A.R. 45/80). As of March 1, 1980, only beer in universal containers was exempted. A universal container was defined as one that could be refilled by more than one brand manufacturer, in more than one location in the province. Deposits on other beer containers were set at five cents.

With the advent of brand-specific refillable beer bottles, it became necessary to strike the phrase "universal container" and substitute "beer and beer containers manufactured in or imported into Alberta by Alberta beer manufacturers and which are returnable to Alberta beer manufacturers or their agents" (A.R. 32/84).

The Act was amended in June 1985, repealing a more specific definition of beverage and simply defining "beverage" as any liquid so designated by the regulations for the purpose of the Act. The amendment also provided for establishment of a Beverage Container Advisory Committee to advise the Minister as to the content, administration, enforcement, and application of the Act.

One of the most prominent consequences of the Beverage Container Act was the establishment of universal depots to handle the returned containers. The soft drink and juice distributors, and the Alberta Liquor Control Board, have established three companies to operate this system. One company, Contain-A-Way Ltd., handles the collection of non-refillable containers for soft drinks and juice; another company, LesWaste Systems, is the hauling agent for containers within Edmonton and Calgary; while the third, L.C.B. Recycling Ltd., is the agent for the Alberta Liquor Control Board, handling all liquor, wine, and imported beer containers. Soft drink manufacturers pick up their refillable containers from retailers and universal depots. Participation by manufacturers in the collection system operated by Contain-A-Way is not mandatory and some bottlers have established their own systems for picking up containers from the depots, perhaps concluding that they could comply with the provisions of the Beverage Container Act at less cost.

The Act originally exempted domestic beer and beer containers because the breweries had in place a well-established system for collecting refillable beer bottles. Beer containers used or imported by the three major breweries are still collected through a network of Alberta

Brewers' Agents depots. In most rural areas, these depots are also universal depots. In urban centers, there are usually separate depots. Beer containers returned to the Alberta Brewers' Agents depots receive full refund. If they are returned to universal depots that are not also licensed as Alberta Brewers' Agents, then a discounted refund will be paid. The depot operator will then return the beer containers to a licensed Alberta Brewers' Agents depot and receive the full deposit.

The Beverage Container Act sets handling charges, which the universal depot operators are paid for each type of container handled. The system is funded by the bottlers based upon their portion of production of each type of container. Any unclaimed deposits and revenue generated by the sale of recovered materials help to offset the operating costs.

Public Attitude Toward the Act

The public hearings engendered a wide range of comment about the Beverage Container Act and the universal depot system. Domglas Ltd., Alberta's major glass container manufacturer, proposed that the Act be repealed for a period of three years during which time industry would be given an opportunity to demonstrate its commitment to recycling (18). This commitment would include establishing receiving centers and assisting municipalities in establishing processing facilities (18). The free market would establish the floor price for glass (18). Domglas felt that glass containers could compete with aluminum and plastic containers in the free market (18), but that the Beverage Container Act and its regulations, which result in multiple handling of soft drink containers, add to the cost of soft drinks and undermine the competitive position of the glass container (18). The established deposit levels also influence the packaging mix for soft drinks, in particular by placing higher deposits on non-refillable glass bottles than on plastic containers or cans (18). As well, the Alberta Liquor Control Board's merchandising policy and highly visible promotions favor can sales over glass for beer and wine coolers, and imported beer and wine over the domestic product (18). The Alberta Liquor Control Board also posts prices that include the deposit. This makes canned beer appear to be about the same price as bottled beer, although there is a 60-cent advantage in deposit level on a dozen cans of beer. In addition, the Act is discriminatory because not all beverage containers are included. Either all beverage containers should be included or none (18).

Like Domglas, the Alberta Soft Drink Association is dissatisfied with the universal depot system. The Association feels that universal depots are inefficient and costly to operate and that there is little incentive for the operators to improve their efficiency because the handling charges can be raised if they need more money. Concern about the efficiency of the universal depot system was also expressed at the public hearings (8). The Alberta Soft Drink Association, however, recognizes the public support for the system and does not feel that it is feasible to rescind the legislation. Instead they would like the universal depot system to be made more efficient and to include domestic beer bottles. An alternative is for the soft drink industry to be allowed to set up its own depot system. Permitting more depots would lead to increased competition and improved efficiency. The Association also supports a "level playing field" with a consistent, mandatory, minimum deposit applied to all non-refillable containers (A. Petersen 1986: pers. comm.).

The Alberta Bottle Depot Association supports retention of the Beverage Container Act, stating that if the Act were withdrawn, Alberta might lose about 1,500 jobs (57). The Association wants flavored-water containers subject to a deposit (57) and beer bottles to be included in the Act (57). The Association would not be opposed to having a uniform deposit placed on each container size regardless of the container material (57). A uniform deposit would simplify the operation of the depot; however, the Association was cautious about public reaction to such a change. The Association favors use of refillable containers because they are the most efficient (57). Manufacturers should be encouraged to use refillables through tax concessions on the production of refillables, or a reduction in sales tax on refillables (57). The savings to the manufacturer should be passed along to the consumer. A visible distinction should be made between refillable and non-refillable containers to encourage the public to use refillables (57). In addition, all containers should carry a standard recycling logo and phrase (57). The Association also recommended that regulations require minimum return rates on non-refillable beverage containers. If these rates are not achieved, a substantial "ecology upcharge" or tax should be applied (57).

Two other briefs (11, 22) supported inclusion of other beverage containers under the Act. One suggested that the deposits be increased to more than five cents on all containers to encourage greater returns (22).

Improvements to the Beverage Container Act

The universal depot system in Alberta is a successful means of achieving the objectives of the Beverage Container Act. The Beverage Container Act and the bottle depots have been in place for 15 years, and there is substantial public support for them. Albertans are used to the fact that their beverage containers have a value, and that they should be saved, stored, and returned. This system is worth retaining and provides a useful base upon which to build.

It is clear that beverage markets are changing and that the materials used to package beverages are changing and will continue to change. The Beverage Container Act and the universal depot system must be able to respond to these changes in a timely fashion. A first step in this process is to bring the Act up to date to include a wider range of beverages and beverage containers and to provide for future changes in containers.

This revision is becoming especially important as packaging changes and as the bottling industry changes. Both the beer and soft drink industries are seeing new, small bottlers entering the market as well as an increasing use of non-refillables. The present wording of the Beverage Container Act and its regulations excludes some of these beverages or their containers; for example, bottled waters and bottled juices are excluded because the regulations set deposits for only "soft drink bottles" rather than beverage bottles. Because the regulations exempt "beer and beer containers ... returnable to Alberta beer manufacturers or their agents", small domestic breweries must provide for the collection of their containers.

Difficulties have arisen because the small breweries have not yet established a widespread return system for their containers. It is therefore debatable as to whether they are "returnable." If they cannot be returned to the manufacturers or their agents, they should be included under the Beverage Container Act. This has not been done and these beer containers remain in limbo. To rectify this problem, beer and beer containers should be included under the Beverage Container Act. Alberta Brewers' Agents would then become universal depots and accept all beverage containers or, alternatively, appoint universal depots as Alberta Brewers' Agents, as is the case for rural depots at present. These changes would result in all depots accepting all containers and paying the full deposit. Handling charges would be paid to all depot operators.

The Panel cannot see any justification for the exemption of some types of beverages and beverage containers from the provisions of the Beverage Container Act. Such exemptions destroy the important quality of neutrality. Government should have no role in deciding whether one type of beverage is better than another, or that one type of packaging is superior or inferior to another. That should be left for the market to decide.

The Panel recommends the inclusion of all beverages under the provisions of the Act with the exception of milk and milk products. Milk has an unique place in western culture and food habits which justifies its exclusion. However, no other beverage, of whatever nature, should be exempted from the provisions of the Act.

Including all other beverages and beverage containers under the Act would result in the collection of some types of containers that are not immediately recyclable. The Panel considered the inclusion of these containers, specifically tetrapak containers, very carefully. After full discussion, it was decided to recommend that tetrapak containers be included in the Beverage Container Act. The Panel does not believe that it is equitable to leave this type of container out of the Act. While it is less than satisfactory to encourage the collection of containers only to subsequently dispose of them, it is hoped that if the containers are collected and available in quantity from a single location it will become possible to recycle them.

This was the case with plastic bottles. These containers were placed under the Act before any recycling route had been established. Initially they were landfilled after collection; then markets were located in the United States and the plastic containers were shipped there, even though no financial gain was obtained. It was not until the past year that a local market developed, for the plastic soft drink containers. It is hoped that events will follow a similar course for presently non-recyclable containers such as the tetrapak container. In the meantime, in keeping with the intent of the Beverage Container Act — to control litter — and the spirit of placing all beverage containers on an even footing, the Panel sees no other route than to recommend the inclusion of all beverage containers under the Act even if they are not immediately recyclable.

If tetrapak containers, for example, were not included under the Act, there would be no incentive to successfully recycle this type of container. It could continue to capture a larger and larger share of the beverage container market and, in the absence of a deposit, become more and more frequently an item tossed away because it is perceived to be valueless.

The Panel also believes that if the Beverage Container Act is to remain effective, any new material introduced as a beverage container should be subject to its provisions.

Recommendation:

> **The Beverage Container Act and its regulations should be amended to include all beverages sold in all types of sealed containers, except milk or milk products.**

Container Deposits

Once all beverages have been included under the Act, the next step in improving the container return system is to have consistent deposits attached to all beverage containers including those covered by the above recommendation, deposits that are neutral with respect to both the material of the beverage container and its contents.

The Panel recognizes that the provincial government took a bold step to combat litter when it passed the Beverage Container Act and later established universal depots. The universal depots provide single points to which all types and makes of bottles could be returned and deposits refunded. In order to understand the changing nature and function of deposits, a short review is required.

Deposits originated as a kind of rental charge by the bottlers. The level of deposit was based on the value of the container to the bottler. If the bottle were returned, the bottler could wash it, refill it, and thus save the cost of purchasing a new bottle. If the customer did not return the bottle, then the bottler retained the deposit and was approximately compensated for a replacement bottle.

As long as refillable containers dominated the packaging mix, the system worked well. However, in the seventies several new factors were introduced. Non-refillable containers appeared on the market. These containers were, in most provinces, "no deposit, no return". The selling point was convenience. The bottlers did not wish to reuse the containers and attached no value to them.

At about the same time, the small independent retailers, with their emphasis on service, were becoming less important. In their place came the supermarket, with its emphasis on efficiency and gleaming cleanliness. Supermarkets were not enthusiastic about handling bottle returns, with the confusion and mess, and although they accepted the return of refillable containers they had sold, their definition of service did not extend to rewarding their customers for the return of other containers.

Finally, with increasing affluence, customers were less motivated to make the effort to save, store, and return their bottles for a deposit that, in a real terms, was declining in value.

One result of these trends was the increasing appearance of discarded beverage containers in the environment. In roadside ditches, in parks, and in public places, they began to constitute noticeable and offensive litter. Albertans have long taken pride in the appearance and cleanliness of their province. The Beverage Container Act was Alberta's response to the problem of litter.

When the Beverage Container Act was passed in 1971, the only experience with the successful return of beverage containers was that of refillable bottles, where deposits were related to the intrinsic value of the container. Since this system was successful, an attempt was made to relate deposits on non-refillable containers to a concept of intrinsic value, even though a non-refillable container has no value to the bottler. The deposit began to relate to the cost of manufacture, not the value of a container's return. The result has been deposits on containers ranging from two cents to 30 cents. A consequence has been that the primary reason for a deposit has been forgotten. The primary reason for a deposit is to motivate the consumer not to litter, but to save, store, and return the container.

The deposit should not relate to any concept of intrinsic value, however defined, since that is no longer the primary purpose of the deposit. The deposit on a container of high value or no value should be the same: sufficient to keep it from being discarded into the environment. A uniform deposit is the simplest means of satisfying this criterion.

Such deposits would provide a level playing field for all manufacturers and all beverages. While there is much to be said for a deposit related to the size of the container or the value of the recoverable material in a container, a standard deposit encourages particularly the return of the smaller container that, relative to the price of the contents, has a higher proportion of the cost tied up in the deposit. Since these are the containers most likely to be littered, the litter control feature of the Beverage Container Act is retained. Larger containers, perhaps because they are used more frequently in the home market, are likely to maintain good return rates even with lower deposit levels.

There is another important, desirable characteristic for a deposit: it should be neutral at the point of purchase. If the same volume of beverage, in equal-sized containers, is available in one instance at 48 cents for the contents plus two cents for a deposit on a can and, in the other instance, at 48 cents for the contents plus a 10-cent deposit for a refillable bottle, there is a real incentive to choose the can at 50 cents rather than the bottle at 58 cents. It is true that, in the long run, when the containers are returned for refund, the two beverages will cost the same, but there is a real incentive at the time of purchase to choose the lower priced non-refillable container. This incentive often is enhanced by the retailers' practice of not posting prices that clearly indicate the level of the deposit.

Since there is an incentive for the bottler to favor the container that carries the lowest out-of-pocket expense to the customer, the present deposit levels constitute an incentive for the cheaper can, the non-refillable bottle, and the multi-layered, multi-material drink box such as the tetrapak or combibloc. The variation in or lack of deposits is a factor in marketing. As Domglas (18) pointed out, it constitutes a real concern for the manufacturer. Deposits should not provide a marketing advantage to containers of one material over containers of another. The deposit should be enough to induce the return of the container, but it should be neutral at the point of purchase.

Finally, a deposit should be simple. Customers should not have to remember that this container has a zero value, this one two cents, this one 10 cents, or whatever. It would be simpler for the bottle depot operator, for the customer, and for the retailer if all beverage containers carried the same deposit.

The deposit therefore should be set:

1) high enough to induce the consumer to save, store, and return the container
2) equal on all kinds of container materials so that the choice of product is not influenced by the deposit
3) the same on all containers for the sake of simplicity and to minimize administration and handling costs.

Recommendation:

> **A single minimum deposit level should be placed on all beverage containers, except those used for milk and milk products.**

The deposit should be sufficient to encourage return of the containers. Information on the return rates for different containers indicates that a higher deposit does increase the return rate although the impact varies depending on the container (T. Rogers 1986: pers. comm.). For example, refillable glass containers, which carry deposits of 10 or 20 cents, have almost a 95 percent return rate. Glass non-refillables, with a five-cent deposit, have a return rate of about 75 percent. About 75 percent of imported beer bottles, with a deposit of 10 cents, are returned, while slightly less than 70 percent of the imported cans, which have a five-cent deposit, are returned. Liquor and wine bottles, with a five-cent deposit, reach 85 percent return rates. For a given beverage, a larger deposit means a greater return rate, although other factors such as purchasing habits, location of use, and frequency of use also affect return rates.

The Panel suggests that the uniform deposit be established at 10 cents. This deposit would be sufficient to encourage high return rates on all containers, but not sufficient to drastically affect the sale of drink in single-serving containers, since single-serving soft drinks already have deposits of up to 10 cents.

Recommendation:

> **A uniform minimum deposit of 10 cents should be set for all containers included under the Beverage Container Act.**

The role of government should be to identify the level of deposit that is simplest, easiest, and cheapest in attracting as many containers as possible to the universal depot for recycling rather than having them littered in the ditches and public places of Alberta. The Panel's recommendations for a single, uniform, minimum 10-cent deposit for all beverages regardless of container types and size are intended to restore an essential strict neutrality with respect to what Albertans consume and the container they choose while at the same time inducing them to collect, store, and return the container.

Universal Depots

The universal depot system has much to offer the public of Alberta in providing a single point to which all beverage containers may be returned. However, the Panel believes that the concerns raised by the Soft Drink Association about the inefficiencies in the system are valid. The universal depot system could benefit from increased competition. In urban centers depots presently are limited to one for each 40,000 persons and generally are spaced at least three km apart (T. Rogers 1986: pers. comm.). These restrictions have made universal depot licences a valuable commodity. There is room for more depots, especially if a wider range of containers is brought under the Act. The recommended amendments to the Act will result in greatly increased numbers of containers being returned. As well, a single deposit level will simplify the depot's operations. As a result, there could be significantly increased profit margins, unless there is also an expansion in the number of depots.

Recommendation:

> **In order to increase the number of universal depots, Alberta Environment should relax the licensing policy concerning the number and locations of these depots.**

Expansion of the universal depot system would make the system more competitive and should encourage the operators to become more efficient and perhaps to expand to accept other commodities for recycling and thus move towards a truly "universal" depot. The Panel has made recommendations elsewhere that the feasibility of the depots accepting non-deposit glass be examined. As well, it is hoped that depots will either accept or pay for other materials such as newspaper and cardboard. Many depots already save and sell their cardboard and could be encouraged to provide this service to the public. Especially noteworthy are the efforts of depots operated by associations for the handicapped. Many of these depots accept container glass, non-deposit aluminum cans, and newspaper and even save aluminum bottle caps for resale. Reviews of future requests for depot licences should look favorably on proposals that include recycling of other commodities.

Recommendation:

> **Alberta Environment guidelines for universal depot licences should include special consideration of proposals that include recycling of commodities not covered by the Beverage Container Act.**

Universal depots have been an important feature of handicapped or sheltered workshops. They have provided useful training facilities for the handicapped, teaching work-related skills in a real-life situation. Recycling in general and universal depots in particular have enabled many with otherwise unused capabilities to do useful work and learn job-related skills that can be used in other settings.

Because of their contribution to the social well-being of the community, the Panel recommends that:

Recommendation:

> **Applications for the establishment of universal depots as sheltered workshops, or as part of a sheltered workshop, should be considered favorably by Alberta Environment and refused only under exceptional circumstances.**

Implementation of the recommended changes to the Beverage Container Act will have substantial repercussions throughout the universal depot system. The recommendations are intended to simplify and streamline the system, making the entire collection process more efficient. As a consequence, the handling charges will have to be adjusted. However, until the industry has had the opportunity to adjust to the changes, it will be very difficult to adequately evaluate handling charges.

Recommendation:

> **A two-year freeze should be placed on handling charges to allow the universal depot operators time to adjust to changes to the Beverage Container Act. During this freeze, there should be a thorough examination of the system in order to determine appropriate handling charges.**

3. OIL DROP PROGRAM

The Oil Drop program is a two-pronged effort by Alberta Environment to recover waste lube oil for recycling. The program has separate approaches for rural and urban sources. In rural areas, local government, waste management authorities, or volunteer organizations may be assisted with the capital expense of buying and installing an oil collection tank through the Resource Recovery Grant Program. Individuals, service stations, and other generators of small volumes of used oil are encouraged to dispose of oil in these collection tanks. Some areas have established a more active system, including pick-up of barrels filled with used oil. Once sufficient volumes are collected, the oil is usually sold to a trucker for subsequent sale to a re-refiner.

In major urban centers, where an established oil collection network exists, Alberta Environment has facilitated the return of small volumes by encouraging service stations to accept used oil from individuals and promoting this service through flyers and advertising.

Oil in small amounts from individuals and from the rural areas remains the major untapped source of recoverable oil (Synergy West Ltd. 1975). Improvements in the recovery of this oil have been made; however, many people are unaware of the Oil Drop program or of the presence of oil collection tanks at many municipal and regional landfills (65, 120). The result is that the recycling system is underutilized (120) and most oil from private changes likely ends up in the landfill. Oil recycling could be expanded (71, 119). A greater emphasis must be placed on developing, maintaining, and promoting both the Oil Drop program and the oil tank placements. In many instances, this could be done in co-operation with municipal governments and through mechanisms such as notices sent out with utility bills.

Recommendation:

> **Alberta Environment, in conjunction with local government, should develop an effective information program to publicize the use of the Oil Drop Program and oil collection tank network.**

4. PESTICIDE CONTAINER COLLECTION PROGRAM

The safe disposal of empty pesticide containers is a concern in rural areas (63, 64, 88, 121). In the past, some pesticide containers were carelessly discarded in ditches, sloughs, and other "wastelands." Residues from these containers threatened surface water and groundwater. In response to this threat, Alberta Environment developed a program to collect empty pesticide containers and dispose of them safely. Special enclosures have been constructed at regional landfills and some seed-cleaning plants, on vacant municipal land, or at other appropriate sites. At present, there are 94 permanent sites throughout the province. These sites are located on level, clay soils, with a pad surrounded by a chain link fence. As well, there are about 40 temporary sites established by municipalities where containers are collected prior to transport by the municipality to the nearest permanent site. Farmers are urged to triple-rinse their containers and leave them in the enclosures.

This system has proven to be quite successful: the number of containers recovered has increased from 80,000 in 1980 to over 643,000 in 1985 (R. Lovell 1986: pers. comm.). The 1985 total is estimated to be between 55 and 70 percent of the containers used (28, 88). The cost of collecting, processing, and transporting the containers to either the steel scrap dealers or to landfill (plastic containers) was $176,000 in 1985. As well, there are the costs of establishing new sites and administering the program, which are borne by Alberta Environment.

In the past, most pesticides were sold in metal containers and a safe route for disposal was to recycle them as steel scrap. The high temperatures in a steel furnace destroy any harmful residues. The steel furnaces in either Calgary or Edmonton are still the disposal route for steel containers. However, the percentage of plastic pesticide containers has been growing (64) and most containers are now plastic. The trend has created an additional disposal problem. Pesticide residues may contaminate the plastic material, making it unsafe to reuse or recycle (88). Research is under way on methods for effectively cleaning the contaminated plastic and making it available for recycling (96). Until an economic cleaning technology has been developed, the present practice of shredding and landfilling the plastic containers will continue. However, regional landfills are often reluctant to landfill the plastic containers and it is possible that the containers as well as the drained residues will go to the Special Waste Management Corporation's treatment facility in Swan Hills when that facility is opened.

In other provinces where there are no special treatment facilities, movements are afoot to have the federal government direct manufacturers to package all pesticides in steel containers. Such a directive would effectively eliminate the problems posed by the disposal of plastic pesticide containers until such time as a satisfactory cleaning and recycling process is developed for plastic pesticide containers. It would also provide an incentive for the plastics industry to improve the recyclability of its containers if it wishes to maintain a market for plastic pesticide containers. Agriculture Canada has responsibility for licensing the packaging and use of pesticides in Canada. The Alberta government should pressure this federal department to direct that pesticides be packaged in containers that are either recyclable or reusable.

Recommendation:

> **The Government of Alberta should recommend to Agriculture Canada that it ban all pesticide containers that are not safely and economically recyclable or reusable.**

Alternatively, if the federal government permits the use of non-recyclable or non-reusable containers for pesticides, then it should bear the cost of their proper disposal. These costs are presently borne by Alberta Environment and include the costs of operating the Pesticide Container Collection Program. In the near future, the cost may also include transportation of the drained residues or the empty containers to the Alberta Special Waste Management Corporation's facility in Swan Hills for disposal.

Recommendation:

> **Agriculture Canada should contribute funds to Alberta to cover the costs of its Pesticide Container Collection Program.**

The federal government may choose to fund the disposal of pesticide containers out of general revenues, but, as an alternative, the Panel suggests that the manufacturers of pesticides be levied with a disposal charge based on the actual costs of disposing of the containers. The charge would be substantially less on steel containers than on plastic containers in recognition of the recyclability and hence lower disposal costs of steel containers. The funds garnered by this charge would then be distributed to the provinces to pay for programs to ensure the safe collection and disposal of the pesticide containers.

B. THE ROLE OF INFORMATION

During the public hearing process, the Panel observed a desire and a need for exchanging information about recycling. At the town hall meetings prior to the hearings and during coffee breaks and discussion periods at the hearings themselves, lengthy informal discussions took place among the audience members. Many people attended the hearings more to learn about recycling in their community than to make a presentation to the Panel. Some frustration was expressed by people wanting to recycle materials but not knowing where and how to do it (52, 103). It appears that the existing potential for recycling is not being realized, partly due to a lack of information.

There are several existing mechanisms for getting information about recycling projects. Charitable groups that use recycling as a fund-raising venture actively advertise their recycling efforts. Word-of-mouth advertising by their supporters is often an important mechanism. Announcements of paper drives, bottle drives, and rummage sales are found in community newspapers around the province. Most radio stations broadcast community service messages including charitable fund-raising recycling projects. Posters appear on bulletin boards at locations around the community.

There are many other recycling opportunities that are not directly associated with charitable organizations. Posters in Alberta Liquor Control Board outlets indicate the location of local universal depots. Gas stations that accept used lube oil from the public display a small Oil Drop sign. The Yellow Pages of the telephone book list scrap metal dealers, paper dealers, and bottle depots. However, private-sector recyclers usually focus on collecting from industrial sources of recyclable material and, although they may be willing to accept the small amounts generated by individual households, they expend little effort to attract such material.

Several suggestions were made to the Panel to improve accessibility to information about recycling. Lists of companies that will pay for recyclables should be distributed to charitable organizations (103). A "how to recycle" guide, possibly funded by industry, would be helpful (101). A recycling "Hot-Line" or telephone information service has good potential (113). In the state of New Jersey, there is a computerized recycling bulletin board (phone 609-641-9418) that contains information on recycling activities. In British Columbia, the Society Promoting Environmental Conservation operates a Recycling Hotline (phone 604-736-8636). These suggestions all have merit and should be considered for application in Alberta.

1. MATERIALS EXCHANGES

Industrial processes produce waste materials and byproducts. These include chemical mixtures, material trimmings, off-spec materials, and so on. However, wastes from one company may be valuable feedstock for another, and this circumstance has led to the establishment of "waste exchanges" throughout North America. There is a Canadian Waste Materials Exchange (phone 416-822-4111) and several provinces have their own waste exchanges. These exchanges provide a mechanism for companies to advertise materials which they would like to get rid of, or to seek certain materials that may be an unwanted byproduct of other companies. Because of these benefits, waste exchanges are welcomed by both industry (40) and those involved in waste management (115).

The Alberta Waste Materials Exchange (AWME) (phone 403-450-5461) is funded by Alberta Environment and managed by the Alberta Research Council. Every two months it publishes and distributes a bulletin containing lists of wastes available and waste materials wanted. Companies are identified by numbers to maintain confidentiality. Should a company see a listing that interests them, the Exchange will put the two parties in touch. The Exchange is not involved in any further arrangements. Also listed in the bulletin are disposal, recycling, and consulting services.

The number of successful exchanges of material made through the AWME is currently unknown; however, a feedback mechanism will soon be in place (K. Beliveau 1986: pers. comm.).

A report on the Northeast Industrial Waste Exchange operating out of Syracuse, New York indicates that over a one-year period, nine percent of the listings were sold and another 12 percent were under negotiation. Although these percentages appear to be low, they represent exchanges totalling 32,244 tons of material at an estimated value of over $1 million (U.S.) (Cutler and Mullen 1986).

During the period from September 1 to November 30, 1986, the Alberta Waste Materials Exchange had 244 listings of available wastes, 78 listings of wanted materials, and 49 listings of available services (Beliveau 1986). During this period the AWME received 139 enquiries (Beliveau 1986). Many of the listings in the Alberta Waste Materials Exchange have potential for reuse or recycling. Examples include used chemicals, oils, scrap metal, plastics, cardboard, building debris, and many others. The Panel notes that this information exchange currently requires only a minor commitment of staff with the main expenditure being publication costs. This relatively inexpensive service potentially can produce substantial benefits by increasing recycling within Alberta's industrial sector. The Panel urges that full support be given to the Alberta Waste Materials Exchange.

Recommendation:

> **Alberta Environment and the Alberta Research Council should place a high priority on maintaining the Alberta Waste Materials Exchange and improving its effectiveness.**

2. TRANSPORTATION

Transportation is a major expense for recyclers. Recyclable materials such as newspaper, cardboard, and glass often accumulate over a period of time and are shipped to market irregularly. It is often difficult to find an economic method of transporting the material to buyers. Some recycling groups manage to arrange for local truckers to take the material to market on backhauls, in return for use of the recycler's trailer, advertising, or other benefits to the trucker rather than on a strictly cash basis.

The Panel sees a good potential for backhauling to reduce some of the transportation costs facing recyclers, as well as benefiting the trucking industry. This practice would be greatly assisted if there were an information system to allow truckers and recyclers to identify backhaul opportunities. This system could take the form of a telephone dispatch service or an information newsletter. Recycling groups could register with this service, indicating the quantity and nature of material to be shipped, and truckers could check with the service when they have an opportunity for backhaul.

Recommendation:

> **Alberta Environment should approach the trucking industry in Alberta to establish an information system to facilitate the use of backhauls for moving recyclable materials.**

3. CONSTRUCTION AND DEMOLITION RUBBLE

As discussed in Chapter II, construction and demolition rubble occupies a lot of space in landfills. Alternative sites on public and private lands that require fill will accept rubble, and are used by many contractors. Alternative disposal options reduce the pressure on sanitary landfills and should be encouraged. Information concerning the location of these alternative disposal sites could be provided when construction or demolition permits are issued by local authorities. Alternatively, some sort of central directory that lists available sites could be established.

Recommendation:

> **Alberta Environment and Alberta Municipal Affairs should establish a system for advertising the locations of disposal sites that would be willing to accept construction and demolition rubble.**

When the service is fully established, municipalities should consider either banning the burying of construction rubble in sanitary landfills or charging a tipping fee that represents the full recovery of the true cost of providing landfill.

The service might develop a computer program that would list sites in the municipality and vicinity that were willing to take construction rubble and under what conditions (clean fill, concrete blocks no longer than a given length, and so on). A printout of this listing could be provided with every demolition permit issued by the municipality.

4. TELEPHONE INFORMATION SERVICE

Personnel in Alberta Environment's Waste Management Division are very knowledgeable about recycling in Alberta and already provide much information to the public. However, this service is underutilized, likely because of its low profile. A well-advertised toll-free number dedicated to recycling information would greatly improve this service. This "Recycling Hot-Line" could be provided by Alberta Environment or may be a worthwhile project for the recently formed Recycling Council of Alberta. Involvement of the recycling industry is important.

Recommendation:

> **Alberta Environment should establish a toll-free telephone service for information about recycling in Alberta.**

Several mechanisms for facilitating information exchange have been discussed. Where possible, these services should be consolidated and provided by a central agency to reduce administrative complexity and prevent overlapping services. A single toll-free number that would provide:

- information about recycling in Alberta
- access to the Alberta Waste Materials Exchange
- availability of backhaul trucking for recycled goods
- disposal sites for construction and demolition rubble

would enhance the utility and accessibility of the service, like the Alberta First Call service, which warns excavators about pipelines and underground utilities.

5. COMPUTER MODELLING

In modern business management, the use of computers is now a standard practice. In waste management, computers are used to plan efficient collection routes, analyze costs, and maintain records. Computer modelling can now be added to these applications. A computer model has been developed for the State of Ohio, to assist municipalities in evaluating the potential for incorporating recycling into their municipal waste management services (Clapham Jr. 1985). The Recycling Computer Model estimates the costs and benefits of different types of collection services for various recyclable commodities. It generates useful information for identifying options worthy of further consideration. It is not intended to be used for detailed planning, but provides a valuable focus for discussions by municipal officials.

The Environment Council of Alberta has a copy of this computer model and has experimented with data from two Alberta municipalities. The results suggest that certain recycling programs could generate revenues for municipalities. The model appears to have real value as a planning tool and should encourage municipal planners to seriously consider recycling as an option. Modifications to this model or development of an alternative model may be desirable to improve applicability for Alberta's municipalities.

Recommendation:

> **Alberta Environment should evaluate the Recycling Computer Model and make modifications to improve its relevance for Alberta. The Department should then make this computer program available to municipalities for use as a planning tool for waste management services.**

C. THE ROLE OF EDUCATION

The Panel was fortunate to hear from a wide range of Albertans representing volunteer groups, recycling industries, government departments, and the general public. A commonly expressed theme was that education is needed to effectively increase recycling in Alberta (28, 43, 57, 73, 80, 95, 101, 118).

Recycling should be seen as an important step toward solving the important environmental and social problem of too much waste. Recycling should not be presented in isolation, but as part of an overall healthy lifestyle. It is also important that other aspects of waste management be taught in order to illustrate the benefits of recycling. Recycling should be presented in the context of the Four R's of waste management: Reduce, Reuse, Recycle, Recover.

1. EDUCATION AND ATTITUDES

The public holds certain attitudes, some of which tend to stimulate recycling in Alberta while others pose barriers. Education is a fundamental tool both for developing positive attitudes and providing practical information (95).

Which attitudes facilitate recycling? Many recyclers expressed support for a conservation ethic: conserve our natural resources, reduce wastefulness, reduce pollution, "live lightly on this planet", don't burden future generations with our wasteful practices... (10, 24, 28, 44, 48, 49, 68, 71, 76, 114, 118, 119, 123). Reference was also made to the lean times of the Great Depression of the 1930s (48) and the recycling drives to support the war efforts during the Second World War (117). People who lived during these periods were left with a keen sense of thrift and the value of reuse and recycling in a resource-poor society. Later generations have been exposed to a more prosperous, consumer-oriented society. Less emphasis is now placed on curbing wastefulness (72). Nevertheless, the Panel was informed that young people show a keen interest in recycling and pollution issues (44). Pollution and the dangers of toxic waste have become high-profile issues in today's society. Societal attitudes seem to be shifting more towards conservation (111). These attitudes are supportive of recycling and, with appropriate education, can be translated into positive action.

Certain other attitudes have inhibited recycling. Attitudes toward solid waste or "garbage" are generally negative. There is little prestige in solid waste. Recycling has generally been associated with garbage collection and hence is tainted by the same stigma (45, 114). This association should be discouraged. When recycling is presented in a more positive light, such as recovering resources or preventing pollution, it is regarded much more favorably.

In today's society, new products usually have more prestige than used or repaired ones. Some products, however, are valued for their age and durability. Old furniture was "built to last" and fine wines improve with age. Recycled materials are sometimes regarded as inferior, even though their quality can be equal or superior to that of virgin materials. Such attitudes make it more difficult to market recycled materials.

If people do not understand the benefits of recycling, they are unlikely to make the additional effort required to recycle their waste materials. Greater public awareness of the benefits of recycling and the jobs created is required. A higher profile for the recycling industry would be beneficial. Recycling can be labor intensive and offers many employment opportunities (43). Funds generated by collecting recyclable materials help to support non-profit organizations and charitable projects. Recycling should be seen as a secondary resource industry for materials recovery, not as a "garbage" industry.

In addition to information about the benefits of recycling, Albertans need to learn how they can recycle. Where can I take my glass food containers to be recycled? Who will take my newspapers? What should I do with my used motor oil? These types of questions were raised at the town hall meetings prior to the public hearings, as well as at the hearings themselves (52, 87, 103), indicating a need for better information exchange between the collectors of recyclables and other members of the community. Without the awareness of opportunities to recycle in the community, good intentions are frustrated. The recommendations made by the Panel concerning information exchange should help to satisfy this need.

2. SOURCES OF EDUCATIONAL MATERIALS

Education takes many forms. It includes formal education in our schools, advertising in the printed and electronic media, simple word-of-mouth, and learning through example. All of these options will play a role in increasing recycling in Alberta.

Responsibility for formal education lies with the provincial government. The Department of Education is the primary agency in this field; however, many other government agencies also have branches that develop educational material. Alberta Environment's Environmental Education Branch has produced a number of relevant resource materials. *A Matter of Waste* outlines a waste education program for grades four to six. "NIMBY" is a game for grades seven to twelve that examines factors affecting waste generation and the complexities of siting a new landfill. The Energy Conservation Branch of Alberta Energy also produces educational packages on energy conservation and could include energy from waste as a topic.

Environment Views, a high-quality magazine published by Alberta Environment, has dedicated a number of issues to recycling and waste management. The Waste Management Branch has produced several brochures explaining their recycling programs. Reports such as *A Waste Management Primer for Alberta* and *Recycling in Alberta* are aimed at educating the general public about this subject.

In addition to government, special interest groups and industries are often interested in developing resource materials for schools. The SEEDS program (Society, Environment and Energy Development Studies) has produced a variety of resource materials. Recycling associations such as the Canadian Association of Recycling Industries (CARI) or the National Association of Recycling Industries (NARI) may be willing to contribute educational materials. Individual corporations may also be interested in supplying relevant information about their role in recycling.

Albertans interested in recycling have recently formed a Recycling Council of Alberta. Recycling associations exist in other parts of Canada. During this enquiry, the Panel met members of the Recycling Council of Ontario, the Greater Vancouver Regional District Recycling Committee, and the Recycling Council of British Columbia. These organizations publish information newsletters, develop educational material, sponsor workshops and conferences, and generally promote recycling. Several meetings have been held to organize the Recycling Council of Alberta, with representatives from the major Alberta recycling industries, non-profit organizations involved in collecting recyclable materials, and other interested groups. The Panel encourages the formation of this non-government council, which could bring a much-needed focus to recycling in Alberta.

3. TARGET AUDIENCES

Information about recycling needs to reach every Albertan. Education will require different methods and resources for different audiences – schools, consumers, and the general public. Some approaches to this important task are outlined below.

Schools

Our children are consumers, waste generators, and future waste managers. The problems that we now face with respect to waste management will likely present them with an even greater challenge. Any significant improvement in attitude must involve this new generation.

The education of our children was suggested as an important strategy for increasing recycling in Alberta (42, 48, 81, 82, 91). An obvious opportunity to teach children about recycling is through the school system. Many people at the hearings recommended that recycling be included in Alberta's school curriculum (9, 10, 16, 24, 29, 43, 44, 48, 55, 61, 64, 80, 90, 95). Recycling need not be taught as a specific unit, but could be included in several subject areas. Officials with the Department of Education suggested that recycling may be suited to the social studies program in the elementary grades and scientific aspects could be introduced in higher grades.

The Panel has examined some of the resource materials pertaining to recycling that are being used in Alberta schools and was impressed with the quality of this material. *A Matter of Waste* is an excellent study package for grades four to six that focuses attention on waste management. It appears to be logically developed, with all of the support material required by students and teachers. Similar material should be developed for other grade levels. The focus should be on the Four R's of waste management, emphasizing the positive aspects of recycling. ACCESS Alberta, the Alberta Educational Communications Corporation, should consider producing a series of audio-visual presentations on this subject.

Recommendation:

> **ACCESS Alberta should produce a series of audio-visual resource materials based upon the Four R's of waste management.**

Finding educational resource materials or ways to develop needed resources should not be very difficult. However, it is important to make the commitment to include recycling in the school curriculum. Representatives of the Department of Education informed the Panel that the department is currently reviewing the secondary school science program and soon will be evaluating the social studies curriculum for the elementary grades. Such reviews provide excellent opportunities to ensure that waste management and recycling are given adequate attention.

Recommendation:

> **The Minister of Education should ensure that when the Alberta school curriculum is reviewed, waste management and recycling are included as an integral part of the curriculum — as part of the knowledge base expected of Alberta citizens.**

Workshops and seminars are offered to practicing teachers to promote improved teaching methods and introduce new resource materials. This in-service training is co-ordinated by the Department of Education, the Alberta Teachers' Association, and the Alberta School Trustees' Association. In-service training provides another opportunity to ensure that recycling is being taught in our schools.

Recommendation:

> **Alberta Education, the Alberta Teachers' Association, and the Alberta School Trustees' Association should ensure that the Four R's of waste management are included in teachers' in-service training.**

Not all school education occurs in the classroom. Field trips to recycling industry sites or waste management facilities should be considered. Many other opportunities exist in schools to introduce recycling habits. School fund-raising projects such as paper drives and bottle drives involve students directly in recycling. Experience such as this is an excellent teacher.

As with any teaching exercise, the availability of appropriate resource materials would attract teachers' interest and help them to conduct these extra-curricular activities. Lists of recycling companies that will offer tours, background information, and "how to" guides for bottle drives, paper recycling, and other projects would be very useful. This resource material may also be useful for youth groups, such as the Boy Scouts and Girl Guides.

Recommendation:

> **Alberta Environment in conjunction with Alberta Education should develop and circulate an information kit describing extra-curricular activities or projects that could be used in Alberta classrooms to encourage recycling habits.**

In addition to its role in educating our children, the Alberta school system is a major institution. It consumes a vast array of materials and generates large quantities of waste.

Recommendation:

> **Alberta Education should direct Alberta school boards to examine and improve the operation of the Alberta school system to better reflect the Four R's of waste management.**

For example, schools are major users of paper. Large amounts of paper are used for photocopying, academic work, art work, and so on. A wide variety of paper grades are used. Recycled paper may be available at competitive prices and may offer savings for school board budgets. It would also boost the market for recycled paper and increase its use in Alberta.

Recommendation:

> **Alberta Education should provide school boards with information about the availability and cost of recycled paper and encourage the boards to take advantage of opportunities to purchase recycled paper.**

Most schools have small incinerators for burning school refuse. Large quantities of high-quality paper are being burned rather than recycled. This is a poor example of waste management to set for students and the local community. Greater effort should be made to establish recycling alternatives to this disposal practice, to introduce the habit of at-source separation and illustrate the value of recyclable materials. It could also generate funds for special school projects.

Recommendation:

> **Alberta Education should encourage schools to recycle paper and other recyclable materials that are currently being incinerated or otherwise disposed of.**

Consumers

Consumer attitudes play an important role in our economy and have a significant influence on waste generation. Purchasing decisions involve many considerations, such as cost, appearance, convenience, utility, durability, and so on. If consumers were to consider recyclability, repairability, packaging, and disposal of the goods they are purchasing, the generation of waste material from this sector would be reduced. In order to encourage consumers to consider these other factors, the public needs to be made aware of the actual burden of waste disposal. The role of the consumer in waste generation should be explained and desirable qualities of consumer products should be described.

Recommendation:

> **Alberta Consumer and Corporate Affairs should develop a consumer education program aimed at reducing the quantity of waste generated by consumer goods and services. This program should focus on reuse, recyclability, repairability, and durability of products, as well as product packaging.**

If consumers are to purchase products that are easily recycled or reduce waste in some manner, then they must be able to identify these favored products. Ready identification can be partly achieved through the recommended consumer awareness programs. A more direct mechanism is the display of a recycling symbol on qualified consumer products.

A variety of recycling symbols are currently in use and efforts are being made to develop a national symbol. There is some debate as to what this symbol should represent: the recyclability of the product or the presence of recycled material. There is value in both of these characteristics. For example, a recycling symbol could distinguish recyclable products from similar products that are not recycled. For example, the aluminum can is easily recycled, but the tetrapak carton, which contains plastic, aluminum, and paper, is currently not recycled. Consumers should be given the opportunity to select the container that is recyclable and a well-recognized symbol would facilitate this.

A recycling symbol could also indicate the presence of recycled materials. For some products, the presence of recycled material is a positive feature. For example, the public may associate recycled paper with saving trees. On the other hand, recycled oil may be wrongly associated with inferior quality. Regardless of quality, consumers may be reluctant to use the re-refined oil in their vehicles. Until the public is aware of the good quality of this product, it may be disadvantageous to advertise this aspect. It should therefore be up to the manufacturer to apply for the right to display the recycling symbol on a product, using the symbol to improve the product's marketability. As public education about the benefits of recycling and the quality of recycled products progresses, other manufacturers will find it to their advantage to advertise the recycled nature of their product. The recycling symbol should be accompanied by appropriate phrases, such as "return to depot" or "100% recycled paper." Some existing recycling symbols are shown in Figure 5.

Recommendation:

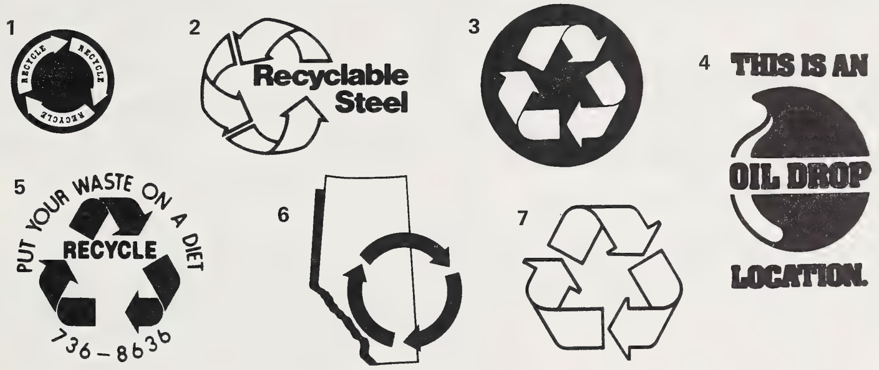
> **Alberta Environment should promote the development of a national recycling symbol. This symbol should be displayed with an appropriate message indicating whether the product is recyclable or contains recycled material.**

The Public

Attitudes that facilitate recycling should be promoted within the general population as well. The federal government has run several very successful programs that have helped to change

FIGURE 5

Recycling Symbols



(1) Alberta Environment's recycling symbol (2) symbol used by the Canadian Tinplate Recycling Council to promote recycling of cans (3) symbol promoted by the American Paper Institute to indicate the use of recycled paper fibers (4) Alberta Environment's Oil Drop program logo (5) Greater Vancouver Regional District Recycling Hot-line logo (6) Alberta Recycling Council logo (7) symbol adopted by Environment Canada.

Canadians' attitudes. One of these was the energy conservation program, which was made visible through product labelling and publication of fuel consumption figures for automobiles. Another successful program was the PARTICIPACTION campaign, which appears to have broad public support and has probably improved public attitude toward physical fitness. As with physical fitness, recycling benefits society as a whole, reducing the amount of waste material, conserving resources, creating economic activity, and so on. However, unlike physical fitness, recycling provides little personal benefit other than the feeling of a job well done. Several people at the public hearings suggested a high-profile campaign similar to the national PARTICIPACTION program (9, 44, 76, 132). The Panel agrees that this type of campaign is needed.

Recommendation:

> **The Minister of Environment, through the Canadian Council of Resource and Environment Ministers, should encourage the federal government to develop and implement a public awareness program focussing on the Four R's of waste management: Reduce, Reuse, Recycle, and Recover.**

D. CO-OPERATION WITH OTHER JURISDICTIONS

Recycling decisions in society reflect existing markets, fiscal policy, regulatory programs, and attitudes. The federal government has important responsibilities in these areas and any provincial program to facilitate recycling requires consideration of the federal government role. Although it is beyond the scope of this inquiry to comprehensively examine federal roles, a number of issues require comment.

The federal responsibilities in the regulation of trade and commerce attracted attention at the hearings, primarily through comments about labelling, packaging, and product design (10, 15, 46, 55, 64, 78, 83, 86, 113). Suggestions were made to boycott goods with excessive packaging (80), to clearly identify recyclable products (21, 57,), to tax or restrict inappropriate packaging (46, 47, 63, 80, 86), and to move towards standardized packaging (78, 83). Products can be designed to facilitate recycling and to minimize waste production (10, 61, 113). One means is to improve the quality of the product and consequently lengthen its life span (62, 78).

Although some of these approaches are possible at the provincial level (80), most of the decisions about product design and production are made elsewhere. The federal government is the only jurisdiction with the ability to influence these decisions. The local level is where there are costs and difficulties with disposing of waste materials: administrative costs and the realities of siting and operating disposal facilities like landfills, incinerators, energy-from-waste plants, and special waste treatment facilities. However, these difficulties are found across the nation. Commonality of problems and concerns also provides opportunities to attain the benefits of integrated federal, provincial, and private sector programs.

For example, paper dominates national municipal waste streams (Bird and Hale et al. 1979; Pilsworth 1984) and is an important component of packaging. Plastic pesticide containers are a disposal problem throughout the Prairies. Even with a small population like Alberta's, present waste disposal costs approach $86 million annually, not including depreciation and long-term liability. Hence the Panel believes that federal action is appropriate:

Recommendation:

> **The Minister of Environment should request the federal government to conduct a study of the impact of product design and packaging upon waste disposal costs and upon the environment. The objective is to establish a set of rules or guidelines for goods marketed in Canada which would:**
>
> **1) reduce waste generation**
> **2) maximize reuse of resources**
> **3) provide for recycling**
> **4) facilitate resource and energy recovery.**

Recommendation:

> **The Minister of Environment should request the federal Department of Consumer and Corporate Affairs and Environment Canada to examine the feasibility of a surcharge or checkoff at the manufacturer or import level that is related to the extra disposal costs generated by non-recyclable packaging, wrapping, and container materials and by products that are difficult to dispose of, such as rubber tires.**

These programs should be co-ordinated through the Canadian Council of Resource and Environment Ministers, supplemented with representatives from provincial departments with trade and economic responsibilities, and business organizations. Assistance may be available from the Province of Quebec on the first recommendation, as their Department of Environment and the Packaging Association of Canada are working towards a code of ethics for packaging (*Resource Recycling* 1986a).

With regard to the second recommendation, the checkoff amount should relate to the current cost of waste incineration (about $50 per tonne), which is a current, proven, safe technology for the disposal of non-recyclable wastes. As information on the true cost of landfill disposal becomes known (as discussed in Chapter II), this level may be modified. Funds obtained from the checkoff program should be used for research and development programs to create packaging materials and product designs that are recyclable or which will facilitate recycling by other industries. Those research programs should be carried out by the industry responsible for the product and the surcharge should terminate when an appropriate percentage level of recyclability is reached. That level should be negotiated with industry.

At present three major candidate materials are made conspicuous by their low level of recyclability and the difficulties that their treatment or degradation in landfills presents: composite materials (for example, tetrapak), plastic wrapping and packaging materials, and rubber tires (particularly steel-belted). There are probably a number of other worthy candidates, but these three products were brought to the Panel's attention as being difficult to recycle, or with low recycling rates. Tires in particular are very difficult to dispose of in a normal landfill. They are all, however, readily disposed of through incineration, but in most locations incineration facilities are not available or, if available, are more costly than landfilling. These products are therefore initial candidates for surcharge of, say, $50 per tonne, with the proceeds to be applied to research and development programs to increase recycling levels of these products to those of paper products or ferrous metals.

Present fiscal policy is biased in favor of the use of virgin materials (Webb 1985, 38, 86, 88, 107, 111). This bias is reflected in the availability of federal government depletion allowances that allow the deduction of 25 percent of resource profits, which is the net income from the production of mineral resources up to the prime metal stage. No comparable provision is available for metals recovery. This means that steel made from iron ore carries a 25 percent advantage over steel made from scrap. There is also provision for accelerated depreciation allowances for pollution control equipment, but this does not include equipment used for recycling (Webb 1985).

Under Canada's Excise Tax Act, a tax is applied against goods manufactured or produced in the country. This provision can create situations where recycled materials are taxed twice. An example is re-refined oil, which must compete with virgin oil. This taxation policy both encourages the use of virgin oil and the disposal, often through landfill, of used oils.

As in the case of packaging, multiple taxation of potentially recyclable materials is both a national and provincial problem, requiring careful attention. The impact of fiscal policy on recycling and the environment is profound. Policy changes are required and this will require federal-provincial co-operation. Fortunately, at the time of writing, discussion on tax reform appears to be under way.

Recommendation:

> **The Alberta government, through the Minister of Environment, should urge the federal Minister of Environment to initiate action within the federal government to treat recyclable goods and materials and virgin materials in an equitable manner with respect to taxes, exemptions, and industrial development programs.**

The intention would be for all provincial Environment Ministers and their federal counterparts to urge the federal Minister of Finance to accept this proposal to ensure that virgin and recycled raw materials are placed on an approximately equal footing and that a greater portion of the waste stream is diverted from costly disposal to the material base for goods-producing industry.

Another way in which demand for recycled materials could be increased would be for the definition of pollution control equipment for the purposes of Accelerated Capital Cost Allowance (ACCA) to be extended to all capital equipment required to process recycled materials. Recycling is certainly one method of reducing or controlling pollution in that it diverts materials from landfills, incinerators, or hazardous waste treatment plants. It should be relatively easy to establish the percentage of the furnish in the processing plant that is recycled material. If the raw material is 100 percent recycled material, as is the case in re-refineries of used oil, the processor would be eligible for ACCA on 100 percent of his capital investment in plant or equipment, not just equipment to reduce or treat stack or pipe emissions. If, in the case of a glass manufacturer, 30 percent of the raw material were cullet, then 30 percent of the additional capital investment would be eligible. The percentage of investment eligible for ACCA could be based on the percentage of recycled materials used in the process during the current taxation year, thus providing an incentive to increase the proportion of recycled material.

The Accelerated Capital Cost Allowance for pollution control equipment provides for the depreciation of such equipment at the rate of 25 percent in the year of purchase, 50 percent in year two, and 25 percent in year three. Since Environment Canada administers this provision, it should find it relatively easy to identify legitimate recycling industries and the appropriate level of ACCA.

This approach would help to rectify the preference provided to virgin materials through depletion allowances, would provide an incentive for industry to increase their use of recycled materials, and thus would increase demand for, and the price of, recycled materials and contribute to a reduction in pollution.

Recommendation:

> **The Alberta Minister of Environment should bring before his colleagues on the Canadian Council of Resource and Environment Ministers the recommendation that all capital**

> **expenditures associated with processing of recyclable materials be eligible for the Accelerated Capital Cost Allowance (ACCA) for pollution control equipment on the basis of the percentage of recyclable material used.**

The Panel also believes better use could be made of available industrial development grants if recycling companies were recognized as manufacturing industries and were eligible for the richest level of industrial development grants. Many companies involved in recycling process waste material into a usable feedstock. For example, scrap metal processors cut scrap metal into usable sizes and remove contaminants such as plastics and upholstery; paper collectors sort and repack paper into a more marketable condition. However, these companies are often ineligible for government grants available to other manufacturers. For example, they would not qualify for funding from the federal Department of Regional and Industrial Expansion (DRIE) unless their processing results in a chemical change or a significant refining of the material (T. Charles 1987: pers. comm.). Only the companies that use the recyclable material to produce a final usable product would qualify.

Plants that use waste materials should be considered for the same level of support, on the basis that they reduce disposal costs while they create new materials. Granting agencies should reassess the criteria for their programs to ensure that they include recycling industries as eligible businesses.

Recommendation:

> **The recycling industry should be considered a manufacturing industry and should be eligible for the full range of industrial development grants.**

The federal government has an important facilitative, informational, and co-ordination role to play whenever a recycling and environmental issue has the potential to benefit society but extends beyond the jurisdiction of a single province. An example of an institution that operates along this line is the Prairie Provinces Water Board (PPWB).

The PPWB provides an opportunity for representatives of Alberta, Saskatchewan, Manitoba, and Canada to meet and discuss water management issues of mutual interest. Agreements can be reached and implemented by the various jurisdictions in a co-ordinated and harmonious fashion. These types of arrangements work very well to ensure that programs are mutually beneficial to the participants.

The Panel suggests establishing a less formal but similar type of arrangement that would facilitate the development of recycling programs in Western Canada. Such an arrangement would need to include the province of British Columbia, and the private sector. The objective would be to encourage implementation of recycling programs where co-operative interprovincial programs are required. Initial agenda topics could include:

1) newspaper recycling and the potential markets for de-inked pulp, and the scale of operation necessary to compete in such markets

2) investigation of the merits of an integrated Western Canada Waste Materials Exchange

3) review of the potential for recycling plastic pesticide containers

4) investigation of costs unique to Western Canadian landfill operations due to climate, soil, or waste stream considerations

5) co-ordination of information and education programs.

Recommendation:

> **Alberta, through the Minister of Environment, should encourage the development of a Western Canadian Recycling Committee. The Committee's prime objective should be to promote co-operative recycling efforts across Western Canada.**

This recommendation could be included as an agenda item at a future Western Premiers' Conference.

Another area where the Western Canadian Recycling Committee could aid national, Western Canadian, and Alberta recycling efforts is through the establishment of an improved information base. Information is required on provincial, national, and international markets and opportunities (10, 15, 41, 77, 79, 80, 90, 101). Such information can be collected, assessed, and dispersed either independently, or as a group. However, where the waste management and recycling interests of the western provinces are similar, it would be desirable to operate a co-operative program.

For example, the Alberta government currently has very little knowledge of international markets for recyclable materials. British Columbia may have better market intelligence, or the potential to collect information effectively from places like the Pacific Rim. They might be willing to share this information with the other western provinces on a co-operative basis. A de-inking plant for newsprint might not be feasible in any one of the western provinces; however, collectively there might be sufficient volumes of old newsprint to warrant one if a co-ordinated Western Canada collection and transportation system could be developed.

Alberta has a major pilot project on waste incineration. Such experience in municipal waste incineration, particularly under extreme cold conditions, would be helpful for the other western provinces.

A Western Canadian Recycling Committee does not require creation of a new bureaucracy. Rather, it can be an agreement that existing staff in the various jurisdictions develop a specialization in an aspect of recycling, such as markets or technology. Information can then be exchanged informally or through a regular publication. The objective is to use existing human resources wisely, rather than adding to staff.

VIII. STIMULATING RECYCLING OF SPECIFIC RESOURCES

A. DEVELOPING MARKETS

It is true that, if the demand for recyclables were to expand and prices were to rise, then recycling would become more attractive for both volunteer organizations and private entrepreneurs. How realistic or how probable is a major expansion of markets for recyclables? At the time of the development of this Report and Recommendations (late 1986, early 1987) there was an almost universal world commodity glut. Most commodities were in plentiful supply with accompanying low prices.

The high price levels of the 1970s for energy, food, and metals did what they were supposed to do — they brought forth additional supplies and reduced demand through substitution and conservation. This has resulted in the present surplus, but that surplus is being absorbed; good conservation habits are being forgotten, and the way is being prepared for another round of resource scarcities and increased prices.

However, the improved prices and the developing shortages of the 1990s are unlikely to be as intense as those of the 1970s. There is the example of the efficacy of high prices to increase increase supply and reduce demand, so it will not be lightly assumed that energy, food, or metal prices will continue an inexorable rise. There is no apparent rising tide of commodity prices that will float the recycling ship. Instead, recyclables, like all types of commodities, will have to compete in the market on the basis of universal criteria of service, quality, availability, continuity, deliverability, and price.

It is on these terms that recyclables have been able to capture their current market shares. For ferrous metals, that represents 100 percent of the Alberta market; for newsprint, perhaps 25 percent is recycled. About 20 percent of the oil is re-refined and all of the glass, plastics, and aluminum collected through the universal depots have found markets. This degree of success means that the easiest, richest, most accessible supplies of recyclable materials are already being recycled. If additional markets are going to be opened up, all the normal skills and practices of the marketer are going to be required. Marketing will be difficult because of both the nature of the products and their distribution.

The only market where Alberta recyclables have an inherent advantage is the local one. All of the readily accessible ferrous metals are being used by the Alberta steel industry and we import supplies from out of the province. All of the local demand for paper for building products (asphalt shingles, roofing paper, insulation) is met locally. Locally, glass is recycled through a glass bead manufacturer and a glass container manufacturer. There is competition from American supplies of used lube oil on a temporary basis because of the closure of some normal markets due to proposed changes in the United States hazardous waste regulations.

The local market is protected primarily by transportation cost barriers that make outside raw materials, as well as competing products, less competitive. This, however, is not immutable. If outside prices drop sufficiently or if a quality feature can be found only outside the province, the local advantage will be lost. There may also be locally available virgin materials that compete directly with recycled material, removing transportation cost barriers.

For example, the use of recycled fiber in paper products must compete with the use of virgin fiber in competing products. Either recycled fiber or virgin fiber, sawdust, or chips may be used in the manufacture of shingles, roofing felt, or paper. The portions of each used may change depending on materials cost, availability, and other production considerations. This substitutability can work to the advantage of secondary fiber as virgin fiber prices increase, or where manufacturers are located close to the source of secondary fiber but distant from wood supplies. For example, Ontario Paper Ltd. is located in southern Ontario close to supplies of used paper, but distant from its supplies of virgin fiber, which must be transported from 1,100 km away. Ontario Paper is presently using 30 percent de-inked newspaper in the manufacture of newsprint. The Panel was told that this percentage is expected to increase to 80 percent.

Because of the large forest industry in Alberta, the use of paper as a feedstock faces stiff competition. Virgin fiber and wood waste such as sawdust and chips are readily available. According to Alberta Forestry, Lands and Wildlife, over 1.8 million oven-dry tons of wood waste (chipwood, bark, sawdust, and shavings) are generated each year in Alberta; although most of this (61 percent) is used by industry, there remains over 700,000 tons which are disposed of primarily by burning (F. McDougall 1986: pers. comm.). Any use of this waste would be welcomed by the sawmill operators because it would reduce disposal costs and provide a return, even if small, from the sale of wood wastes.

It is difficult for most Alberta recyclables to compete on price. Nevertheless, Alberta is a sufficiently large market to warrant its own electric arc steel mills, its own building products industry, its own glass plants, and oil re-refineries. Alberta is a price taker, responding to prices established on world markets, usually too small a player to influence either supply or demand.

As well as being adversely affected by the present low world prices for crude oil, the price for used oil in Alberta has been affected by recent debate in the United States which has brought additional used oil into Canada. Re-refineries in Alberta have been in a position to demand and receive large volumes of good quality oil at reasonable prices from United States industrial sources. This has affected the price for small-volume loads in Alberta. As well, the re-refineries can be discriminating about the quality of oil that they will accept.

One way of developing markets is to develop a continuous, assured supply of a product of known and consistent quality. In this respect the Beverage Container Act and the universal depots can be considered to be marketing tools. The collection system has created a ready supply of color-sorted glass. Two major glass users in Alberta now use cullet (broken glass) to replace much of their raw material needs, Domglas in the manufacture of glass containers and Canasphere Industries in the manufacture of glass beads. These companies obtain most of their cullet through the bottle return system and from bottlers of beer and soft drinks. Minor amounts come from other industrial sources and from individuals.

Other containers collected as a result of the beverage container legislation provide a stable supply of plastic sorted by color and of cans sorted by metal. When the universal depots started collecting containers, there was no market for the non-refillable containers. These containers were shipped to landfills. However, when glass bottles were segregated by color, the cullet became attractive to glass product manufacturers, and plastic PET bottles are being used by Applied Polymer Products Ltd. to make a variety of products. Because of the advantage provided by the assured supply of a quality material, these companies have been able to develop markets extending far beyond Alberta. The aluminum cans have to be shipped to markets outside the province, but there is at least a ready market for used aluminum beverage containers.

Some of the normal marketing tools — product differentiations and brand name identification — are difficult to apply to recyclable feedstocks. Alberta's used newsprint or old corrugated cardboard is no different than that produced elsewhere. Quality control is almost entirely a product of buyer vigilance rather than a result of Alberta's climate, soil, or processes.

The same concern for transportation costs that applies to other Alberta products is even greater for the recyclables. The classic theory is that when transport costs are high, the producer concentrates on low bulk, high-value products. However, many recyclables are inherently low-value products, often of high bulk, like corrugated cardboard. Recyclables must compete primarily on the basis of price against virgin raw materials and are therefore particularly sensitive to transportation costs. There is a world market for all of Alberta's recyclables. The problem is that once the transportation costs to those markets have been paid, there is little left over to reward the Alberta recycler for the costs of collection, sorting, and processing. Recyclables will benefit from any action taken to reduce transportation costs, but, other than direct subsidies, there seems to be little that the recycling industry can do to reduce transportation costs. Transportation subsidies for recyclables are not recommended by the Panel except in some exceptional circumstances such as overcoming internal provincial transport costs from isolated locations.

The steel industry takes advantage of the protection offered by transportation costs in another way, to allow it to develop and maintain a presence in Alberta. A two-tiered price system exists for scrap. The price for local scrap is considerably below the price that must be paid for scrap purchased outside of Alberta. The difference is somewhat less than the cost of transportation to these export markets and thus it is not economically feasible to ship local scrap to out-of-province markets. The concern was expressed at the hearings that this pricing structure resulted in an unfair price for local scrap (15, 87). It was further stated that most major producers of industrial scrap are committed to recovering and selling their scrap, almost regardless of price, because of the savings in disposal costs. Therefore, obsolete (post-consumer) scrap bears the brunt of fluctuating demand and price (15).

Stelco stated that the two-tiered price structure gives it stability of supply and maximum inflow of materials at reasonable cost. The steel industry faces stiff competition from other producers and there is a significant overcapacity in world steel production. If prices for local scrap were increased, the increased price would be applicable to all scrap, but the incremental increase in local scrap recovery probably would not meet all of the scrap requirements and scrap would still have to be imported. As a result, the average cost per tonne for the combined purchase of local and imported scrap would probably be higher than the present costs. To offset the lower local prices, Stelco offers a stable price and an unlimited market to 11 dealers. Stelco, rather than the dealers, assumes responsibility for holding excess inventory until it is needed. Pricing is on the basis of zones. There are five pricing zones in Alberta, with a common base price but different freight allowances (133).

The pricing structure for non-ferrous metals (for example, copper, zinc, brass, and aluminum) is different from that for ferrous metals. Prices are not determined locally but are based on international markets and the price of the primary metal (15). With a much higher value for non-ferrous metals, the costs of collection, processing, and transportation have less impact (15), and collected material can be transported to distant markets. As a result, most non-ferrous scrap from Alberta is exported to other provinces or outside of the country.

One classical factor in market development that Alberta lacks is market intelligence. Information on the Taiwanese or South Korean markets for waste paper is unavailable from either federal or provincial sources. The United States, on the other hand, has captured 92.5 percent of the South Korean market for waste paper (Canada has 0.7 percent) (Powell 1986) and shipped over 1.3 million tons of waste paper to South Korea and Taiwan in 1985 (*Resource Recycling* 1986b). The United States presumably has a completely developed commercial market intelligence network that is fully conversant with current market conditions and trends. In the absence of equivalent quantity and quality of information about these markets, it is not likely that Alberta will be able to compete effectively.

Neither current market conditions nor trends in demands for recyclables suggest that any automatic expansion of markets will provide an easy engine of growth for recycling in Alberta. The markets for recyclables are currently intensively competitive and they will remain that way. There are markets for Alberta's recyclables, but they are neither rich nor automatic; they will require continuous attention to costs, particularly transportation costs, as well as high quality and consistency of product.

In the following sections, the report deals in much greater detail with recycling of several commodities: glass, paper, oil, plastic, metal, and rubber. In these sections, the specifics of developing markets, as well as sources of these materials, are addressed and recommendations are made to improve on the present level of recycling.

These following sections are based on information gathered during the public hearing process. Earlier reports by the Council provide background information on recycling and highlight issues that were likely to be raised at the hearings. *Resource Recycling in Alberta* (Lilley 1985b) provides an overview of recycling for several commodities. During the hearings and through subsequent tours of recycling operations, meetings with representatives of government departments, and attendance at conferences, the Panel was able to add to the existing information base on recycling these commodities.

B. GLASS

The Beverage Container Act (RSA 1980 c. B4) is a major factor influencing glass recycling in Alberta. As discussed in Section VII A, the Act provides for the establishment of universal depots and the passage of regulations setting minimum deposits for beverage containers.

As a result of the implementation of the Beverage Container Act and the existence of the Alberta Brewers' Agents depots for domestic beer containers, Albertans have a lengthy history of returning beverage containers for refund of the deposit.

Universal depots are required to accept only those containers specified by the Beverage Container Act. Most of the excluded beverage containers, food containers, and some discarded deposit containers end up in the municipal waste. Container glass comprises about 4.4 percent of municipal waste (Lilley 1985b) or about 79,000 tonnes per year – more than the total recovered through the bottle depots. About 46,600 tonnes of container glass are discarded in Calgary and Edmonton, the remaining 32,400 tonnes at locations throughout the province (Free 1985).

According to comments received at the hearings, opportunities to recycle this glass are desired (17, 43, 48, 103). Some briefs recommended a deposit on glass food containers and beverage containers (18, 57, 61, 80, 129). Extension of deposits to such items would encourage their return and facilitate recycling (10, 18, 36, 53, 61, 80, 129). In response to these concerns, the Panel has recommended that all beverage containers and all beverages, except milk, be included under the Beverage Container Act (Section VII A). Implementation of this recommendation would increase the supply of cullet and further reduce the amount of beverage container glass in the waste stream.

The economics and desirability of expanding the deposit refund system to food containers needs to be examined carefully. It should be remembered that the original motivation for the Beverage Container Act was litter control. Litter control benefits cannot be associated with the return of food containers. Also, it is not practical to give the responsibility for return of food containers to the food manufacturers or distributors as is done for beverage containers. Little of our food is canned in Alberta; it enters the province from a large number of sources, many of them outside of the country. Food containers come in a vast array of shapes, sizes, and weights. If deposits were placed on food containers, then the entire costs of regulating and controlling their return would have to be borne by the taxpayer. A similar situation exists for liquor and wine bottles, but there are litter control benefits that would not be evident with food containers. Recovery of the glass for recycling alone would not justify the expense of collecting and processing food containers if they were included under the Beverage Container Act. There are other mechanisms for encouraging recycling of food container glass that are much more practical, and recommendations are presented later in this section.

In smaller centers, the accumulation of sufficient quantities of cullet for shipment to market is a long process. Nevertheless, some volunteer organizations are collecting this glass as a fund-raising activity. Universal depot operators, especially those close to markets in southern Alberta, may perceive a financial benefit in recycling non-beverage container glass because little extra effort is required to accept glass dropped off at the depot. Incremental costs are associated with warehousing, handling, and transportation. Some of the advantages for southern Alberta operators are apparent in prices and transportation costs. The current net return associated with moving cullet in 35 tonne "B" train units from Edmonton to Domglas in Redcliff is $30 per tonne, based on a price of $57 per tonne delivered to Redcliff less $27 per tonne transportation costs. The net return for cullet delivered from Calgary to Redcliff is $43 per tonne ($55 per tonne delivered price minus $12 per tonne transportation costs) (D. Hall 1986: pers. comm.). These prices and transportation costs illustrate the increasing attractiveness of being close to the major market.

One privately operated depot in Lethbridge, as well as some depots operated by rehabilitation centers, for example, Redi Enterprises in Medicine Hat (21), Cosmos Enterprises in Red Deer (130), and Centra Cam in Camrose (66), accept non-deposit glass. Other non-profit organizations that collect glass include groups in Camrose (63), Rimbey (42), and Lethbridge (34). Some of these projects have yet to ship any glass. Those that have consider the availability of free or subsidized transportation as necessary if the returns on glass recycling are to justify collection and shipping. Often transportation deals are available with local truckers. Domglas, the major purchaser of post-consumer cullet in Alberta, also offers a transportation subsidy of about $1 per tonne per 100 km, but this alone is not enough to encourage cullet recovery.

The profitability of recycling non-beverage containers is greatly affected by the limited markets for cullet and the location of these markets. There is one customer for non-beverage container cullet in small amounts — Domglas in Redcliff. Domglas pays about three cents per pound for glass delivered to the plant gate. This return is sufficient to encourage local residents and community groups to recycle glass, but will barely cover transportation costs for small loads from other areas. As a result, non-beverage container cullet makes up only 0.5 per cent of the plant's feedstock. Canasphere Industries Ltd. in Calgary gets enough cullet (flint, or clear, only) from the Alberta Liquor Control Board through Contain-A-Way, and from industrial sources, to meet its demand. Flint cullet collected by others may also be purchased if available in large amounts, that is, more than a tonne. The price is somewhat less than that offered by Domglas.

Cullet can be used in the manufacture of fiberglass at levels of up to 30 percent on a continuous basis (82). There are two fiberglass manufacturing plants in Alberta, in Edmonton and in Innisfail. The plants use small amounts of uncured scrap fiberglass generated in the manufacturing process and recently one company purchased pulverized cullet from Canasphere. Both companies expressed interest in using cullet from outside sources (40, 82). The use of cullet would depend on chemical compatibility, cost, internal costs such as increased wear on machinery and handling costs, continuity of supply, and plant shutdown threat (82). The cullet would have to be delivered in a processed form: free of metals, plastics, paper, aluminum, and organics (82) and crushed to about one-quarter inch in size.

Although fiberglass companies would not be major consumers of cullet, the potential for diversifying the markets, especially in northern Alberta, should not be overlooked. A detailed study should be undertaken to determine the feasibility of using cullet in these industries and to enumerate steps that might be taken to encourage development of this market. The development of a processing facility to supply cullet of the desired specifications should be included in the study.

Recommendation:

> **Alberta Environment and Alberta Economic Development and Trade, in conjunction with the fiberglass industry, should undertake a study to determine the feasibility and economics of supplying cullet, especially green, for use by the fiberglass industry.**

A program that may have a significant long-term impact on glass recycling is the City of Edmonton's pilot curbside collection project. This one-year project is expected to generate about 100 tonnes of cullet, which will likely be shipped to Domglas. If the program is successful and expanded to city-wide coverage, the local supply of cullet might provide an added incentive to the fiberglass industry to use cullet.

Increased recycling of non-beverage container glass seems to hinge on improving economics through reducing transportation costs or diversifying markets. If better markets for cullet could be developed near Calgary and Edmonton, collection of cullet, at least by volunteer organizations, would be encouraged. Diversified markets could increase the competition and perhaps the price of cullet, but also would reduce haulage distances and therefore transportation costs.

Expansion of the markets would benefit most significantly the recycling of glass in areas close to markets and in locations that are able to accumulate sufficient volumes to take advantage of lower freight rates for large loads. In rural Alberta, large quantities of cullet will be accumulated only over time. If glass recycling is to be encouraged, ways must be found to reduce transportation costs and make collection of glass an economic proposition for volunteer organizations or private enterprise.

One option is to develop Contain-A-Way as a buyer of non-deposit glass at its warehouses in Edmonton and Calgary. Contain-A-Way accepts non-deposit glass at its warehouses as a public service but offers no payment. The glass is processed with the deposit glass and sent in 35-tonne loads to Redcliff or Calgary. The cost data presented earlier indicate a net return of between $27 and $43 per tonne (selling price less transportation costs). Even allowing for processing and handling costs, there appears to be a net return to Contain-A-Way for handling this glass.

Contain-A-Way is an agent for the Alberta Liquor Control Board and soft drink manufacturers in handling the collecting and processing of glass beverage containers. The operation of the system is determined by bidding. Because the Liquor Control Board is now the major generator of glass entering the universal depot system, it may be possible to expand the responsibilities of the agents to the purchasing of non-deposit glass. If some return, even as low as $20 per tonne, could be provided to non-profit organizations, these groups would have reasonable access to markets and would be encouraged in their efforts to recycle non-deposit glass. To keep costs to a minimum, it is suggested that Contain-A-Way limit its buying to volumes of perhaps one tonne or over.

Recommendation:

> **In order to facilitate the recycling of non-deposit glass, the Alberta Liquor Control Board and Alberta Environment should investigate the feasibility and desirability of**

> **Contain-A-Way purchasing bulk loads (one tonne or more) of non-deposit glass at its warehouses in Calgary and Edmonton.**

The Alberta Bottle Depot Association indicated its willingness to assist with the voluntary recovery of recyclable materials (57). Universal depot operators might collect non-deposit glass if they too could sell the glass to Contain-A-Way. Transportation costs would have to be deducted from the price if glass were picked up at the depots. However, these costs could be minimized by piggy-backing the non-deposit glass with the transport of deposit glass to Contain-A-Way's glass-processing facilities in Edmonton and Calgary.

Recommendation:

> **Alberta Environment should investigate the feasibility of including non-deposit glass from universal depots in the current system for collecting and transporting beverage containers.**

A high degree of interest in recycling non-deposit glass was expressed at the hearings, and the Panel believes that these two steps would greatly increase the amount of this glass being recovered as well as provide a small return for recyclers.

C. PAPER

Recycling of paper involves many different grades, with different characteristics, different end uses, and, therefore, different values. The most common grades are old newsprint (ONP), old corrugated cardboard (OCC), ledger, computer printout (CPO), and mixed. Each grade of paper should be considered separately because the sources and often the markets are different.

Old newspaper is available mainly from households. Collection depends on individuals dropping papers at collection bins or depots or participating in collection drives. High levels of participation can be achieved if it is made easier to recycle newspapers than to throw them out (3). Individuals may feel that recycling saves trees (30, 52) and energy (38), reduces water pollution (30), or increases the life span of the local landfill. There is little financial incentive unless an individual sells the paper directly to a dealer, and even so the price per kilogram is low.

Old corrugated cardboard comes mainly from commercial and industrial sources and is usually sold directly to a dealer. If private enterprise is to recycle, it must make economic sense. The costs involved must be offset by savings in waste disposal costs, income from the sale of materials, a feeling of supporting community spirit and projects, or concerns about environmental protection. The costs associated with recycling include time, space, and equipment. Time is required to educate staff, sort and prepare materials for market, and perhaps to transport material to market. Space is required for the accumulated material; equipment such as bins and balers may be required. Recycling of old corrugated cardboard may not meet these costs, depending on individual circumstances such as building layout, wage rates, and transportation costs (101).

Ledger and computer printout comes from government buildings, universities, institutions, and from private enterprise. Both Alberta Environment and Environment Canada have programs to recycle paper produced internally and are working toward implementing similar programs in other departments. The City of Edmonton has an office paper recycling program in at least one department (76). The Universities of Calgary and Alberta have collected paper for recycling (12, 87) and several office buildings have paper recycling programs. Efforts have also been made to recover paper through sorting of mixed wastes produced in office buildings (3). Alberta Environment has also sent some of its collected paper to a rehabilitation center for further sorting by grade to improve the quality of paper stocks recovered.

Office paper may be recycled as part of an overall strategy to reduce costs, including waste management costs. But it is more likely recycled to project a corporate image, or to express an awareness of environmental concerns. However, recycling of office paper requires the consistent and continuous support of the workers. Assistance of the cleaning staff is often required as well, and this may mean special clauses in the maintenance contract. Initially, a capital outlay may be required to provide desk-top paper containers, floor bins, and collection containers. Education of staff is required, as well as periodic reminders to maintain participation rates and high quality in the recovered paper. Often there is little incentive for the individual to recover paper, since revenues may go to general office or government funds. The company may not even benefit directly if reduced waste disposal costs are reflected only indirectly in lower office rental costs. There is more incentive to participate where benefits go directly to the workers through Christmas party or coffee funds.

Recycling of office paper may be deterred by a lack of suitable storage space for accumulation of the paper on each floor or in the loading areas. Storage areas for paper may have to meet fire regulations, including having a sprinkler system and a fireproof door. Environment Canada has been encouraging designers of new federal buildings to incorporate features that facilitate recycling.

Previously Alberta markets for recycled paper were dominated by the use of newspaper in insulation or building materials like roofing felt, shingles, and the backing for wallboard. The demand was for old newspaper and mixed grades; other grades, such as old corrugated cardboard, were supplied by industrial and commercial sources. The dependence of paper recycling on the building trade and insulation business resulted in variable markets and prices. At one time, paper was even imported into Alberta to meet the demand.

As a result of fluctuations associated with cycles in the construction industry, the organizers of paper drives sometimes received less money than anticipated or found no buyer for the collected paper. The City of Edmonton tried curbside collection of newspapers in the late 1970s and had to landfill the collected paper (90). Some companies buying paper changed hands or went bankrupt. People grew leery of paper recycling as a fund-raising activity or business venture. Non-profit groups conducted paper drives as funds were required or when prices were high. When prices were low, collection stopped and supplies dried up. This increased the price swings and made business difficult for paper buyers.

But times have changed. New markets exist for Alberta paper. Locally, old newspaper is used in the manufacture of animal bedding as well as in building materials and cellulose insulation. Paper is exported to British Columbia for use in a paperboard mill, to Oregon for de-inking and use in paper manufacture, or to Pacific Rim countries. Belkin Paperboard in British Columbia expanded its paperboard mill and now uses about 170,000 tonnes of waste paper annually (92). To help supply this demand, Belkin Paper Stock Inc. established offices in Alberta. Belkin's demand for paper has helped stabilize the market (39). The company's consumption of Alberta paper has grown from 12,000 tonnes in 1982 to in excess of 38,000 tonnes in 1986 (92). The increase in consumption has been met mainly by OCC, although there has been some increase in the use of ONP (92). The present level of consumption by Belkin is divided as follows: OCC, 66 percent; news, 22 percent; mixed, 7 percent; and other, 5 percent (92).

Assisted by the Resource Recovery Grant Program, many non-profit organizations in Alberta now are actively involved in paper recycling (21, 23, 24, 26, 27, 33, 41, 42, 48, 52, 59, 61, 66, 71, 83, 105, 130). Most projects concentrate on newspaper because it is relatively easy to collect and handle; a few groups collect old corrugated cardboard.

Foothills Conservation and Recycling Ltd. operates a curbside collection program in Calgary and collects between 3,000 and 3,600 tonnes of newspaper each year (3). The Panel also heard from an individual who collects about 30 to 40 tonnes of paper per month as a means of making a living (5).

Some projects in rural Alberta are taking advantage of the demand, accessibility, and higher prices for other grades of paper, especially OCC, and are collecting these grades as well as newspaper. A few examples were described at the hearings (21, 33, 48, 59, 66).

A number of people recommended increasing the collection of paper and increasing the demand for recycled paper in order to increase the overall level of recycling. Schools, government offices, and private organizations should be encouraged to recycle (11, 44) and should take the lead in using and promoting the use of recycled paper (76, 80, 132). Setting an example would help others overcome objections to the use of recycled paper (132). The use of a recycling logo on the daily newspaper also would increase public awareness and participation rates (59), and all recycled paper should be identified as such (48).

Municipal bylaws may be required to make recycling more attractive than landfilling to waste haulers (79). The same end might be achieved if landfill costs were accurately and fully assessed and passed on to the waste generator (92). Diversion credits would make recycling more economically rewarding (3, 71). Tax incentives for the use of recycled paper (43) or government assistance in developing products using recycled paper (127) are alternatives. Provincial legislation might also be used, for example, to require that a small percentage of old newspaper be used as raw material in pulp mills (3).

The Panel agrees that the provincial government should take a stronger role in using recycled paper.

Recommendation:

> **Alberta Public Works, Supply and Services should investigate the feasibility of requesting suppliers of paper to the government to supply paper containing recycled fiber.**

Each grade of paper likely requires specific attention if economic recycling is to be increased. For some grades, such as news and mixed, market expansion is important, for other grades, such as ledger, computer printout, and old corrugated cardboard, the market can absorb a considerable increase in supply without affecting the price structure dramatically. In these later cases, effort should be directed towards development of supply.

According to Belkin, growth in demand for news grade looks flat. The present level of recycling is about 22,500 tonnes per year (92). About 12,500 tonnes is used in Alberta in the manufacture of paperboard and roofing materials; 10,000 tonnes is exported to British Columbia or the United States (92). Belkin estimates that about 43,000 tonnes of ONP are potentially recoverable from urban municipalities in Alberta with populations greater than 10,000 (92). This calculation assumes 60 percent participation. But any significant increase in the supply in advance of the development of additional markets would be detrimental to the price (92). The present price for old news, although stable, is already depressed due to depressed prices for finished products and low prices for virgin fiber (92). Belkin recommended against encouraging curbside collection of newspaper in Alberta since this could flood the market. Prices for newspaper would fall and projects in rural Alberta could be threatened (92).

The situation for mixed paper is similar. Mixed paper is used by Belkin in British Columbia, by IKO Industries in Calgary, and by Building Products Ltd. in Edmonton. The present consumption of approximately 20,000 tonnes per year is in balance with the supply (92) and no effort should be made to increase recycling of this grade of paper (92).

The demand for old corrugated cardboard, however, is quite different and priority should be given to increasing the supply (92). While the local demand for old corrugated cardboard (Calgary and Edmonton) is apparently met by existing levels of recycling, Belkin stated that it could increase its purchases of old corrugated cardboard from the current 25,000 tonnes per year to 55,000 tonnes per year without depressing the present price of $45 per tonne (92). The material would be processed into high-density bales and shipped to the Belkin Paperboard mill in British Columbia.

The demand for other grades, including computer printout and ledger, is high and the Alberta recycling industry can absorb any additional tonnage at the current price levels (92). These grades are used locally and are also required by Belkin in its mill in British Columbia. Belkin currently imports much of its ledger from the United States. Any increase in recovery of this material in Alberta would reduce these imports. Any action to encourage recovery of these grades of paper from commercial and industrial sectors would be most helpful (92).

While office buildings offer a good source of computer printout and ledger paper, recycling programs are often difficult to implement in office buildings. Alberta Environment and several other generators have implemented office paper recycling programs based on source separation, but stronger government leadership is required. The Alberta Environment program has not received the commitment, publicity, and recognition that it deserves.

Recommendation:

> **To show government support and leadership in recycling, Alberta Environment should consider its office paper recovery program an example for other office buildings, take steps to increase public awareness of the program, and encourage implementation by other major generators, beginning initially with provincial government departments and agencies.**

Several organizations have dropped their paper recycling programs or are experiencing difficulties because of the poor returns received for the effort involved (17, 19, 21, 41, 63, 71, 73, 87, 90, 130). A basic difficulty is that the cost of collection and transportation often are only just covered by revenues from the sale of the paper. This problem is encountered by both private entrepreneurs and volunteer organizations, especially in rural areas.

Some non-profit groups have expanded their collection into other grades of paper, such as cardboard. Expansion often requires additional space and preparation of materials for market. Transportation of old corrugated cardboard usually means baling and compression. Sometimes grants can be obtained. Financial assistance for the purchase of baling equipment may be appropriate in smaller Alberta communities to assist in the development of supplies (92). In the larger Alberta cities, Belkin is prepared to absorb the cost of putting in balers and then will recover the costs through revenues generated by the project. Such projects would also need encouragement and support from local government (92). In other cases, groups use balers owned by local businesses.

Demand for old corrugated cardboard is strong, and paper dealers have been actively seeking new supplies. It appears that most of the larger, steady supplies have already been tapped and increased supplies will generally come from smaller, less accessible sources. Many of these will be in rural areas, which means the material must be baled to make transportation economic. The Panel appreciates the offer by Belkin to assist with the cost of baling in some locations (92), but recognizes that in some areas there may be insufficient cardboard to justify a permanent baler.

Recommendation:

> **The feasibility of using a mobile baler to increase recycling of old corrugated cardboard in rural areas should be investigated by Alberta Environment.**

In some instances, the use of local balers is permitted but there are concerns about liability and access to business premises. If these concerns were overcome, greater access to balers would be available.

Recommendation:

> **Alberta Environment should investigate ways for potential recyclers to have access to balers in local businesses, or liquor stores.**

A cardboard baler is a very expensive item and often expansion of the recycling facility is required to house the baler. A few projects may thus use up the present annual budget for the grant program. But baling cardboard is, in many aspects, similar to baling operations carried out routinely in the agricultural sector. Hay balers have been modified and used successfully for baling cardboard. There is much ingenuity in the agriculture sector that could be applied to using this common piece of equipment to solve this problem.

Recommendation:

> **Alberta Environment should issue a call for proposals to adapt agricultural balers for baling old corrugated cardboard.**

Sources of old corrugated cardboard undoubtedly exist in urban areas as well as the rural areas. Many of these are businesses unaware of the demand for their waste materials. Shopping malls in particular may represent a major untapped source of paper, especially cardboard (R. Malanchuk 1986: pers. comm.). The waste audit program recommended in Chapter III will assist commercial and manufacturing companies to identify recyclable materials, including old corrugated cardboard. The Alberta Waste Materials Exchange Newsletter provides another opportunity to put generators of recyclable materials in touch with prospective buyers.

Some people involved in paper recycling expressed concern over the low prices paid in Alberta and the discrepancy between these prices and prices in the northwestern United States (35, 66, 130). According to Belkin, the price differentials result from the added cost of sorting, baling into mill-size bales, and transporting to markets. Other companies in Alberta can set their prices based on Belkin's prices because the supply of paper in Alberta is surplus to the requirements of Alberta industries. Without the demand by Belkin for its mill in British Columbia, the price offered for paper would be less. Belkin suggested that recycling in Alberta could be encouraged by providing freight subsidies that would allow recycled paper from Alberta access to markets in the United States and Pacific Rim countries. Belkin recommended investigation of the cost of these subsidies versus the benefits to be gained by increased recycling of old newspaper (92).

The recovery of newspaper in Alberta is likely to increase with the advent of curbside collection programs and expanded use of drop-off centers. New markets, especially for old newspaper, are needed. Among the options to be examined are: Pacific Rim markets, improved access to United States markets, and development of local or regional end users, such as a paper mill, de-inked pulp mill, or manufacturer of other paper products.

Recommendation:

> **A major market survey and feasibility study should be conducted by Alberta Economic Development and Trade to determine the markets for all grades of paper, and the feasibility of accessing domestic and foreign markets.**

Development of a major new market for recycled fiber would provide a great stimulus to the collection of paper. One such market is as feedstock for a de-inking mill to produce paper or market pulp. In Ontario, the demand for fiber by a de-ink newsprint mill and several other manufacturers of paper products has increased demand and stabilized prices at levels considerably higher than in Alberta. For example, old newspaper sells for $55 per tonne and the company will pay freight costs from most locations in southern Ontario. But is a de-inking mill feasible in western Canada? Technically, the mill could produce pulp or paper at a price competitive with a mill using groundwood, but it would face severe difficulties.

Consider, for example, locating a de-inking plant in British Columbia close to access to the Pacific Rim countries. These countries are large and growing users of both pulp and secondary fiber and may be a market for de-ink pulp. The expertise exists in British Columbia and Alberta to develop the collection infrastructure necessary to supply the mill, and the waste disposal situation is such that jurisdictions, especially in the Lower Mainland, would be willing to facilitate the collection of paper. Opportunities may exist to use a backhaul or containerization to bring paper from the prairie provinces to the mill.

But is there sufficient old newspaper in western Canada to supply a mill and could the products be marketed? Additional production, especially using de-inking processes, would face very difficult markets. To supply the mill may require about 100,000 tonnes of old newspaper per year – more than the total amount of paper sold annually in Alberta. Significant recycling of old newspaper is already under way in British Columbia and Alberta, with paper being gathered from Alberta for shipment to British Columbia. This suggests that the easiest sources of paper in British Columbia are already being recovered. Collecting an additional 100,000 tonnes of old newspaper each year could drastically disrupt the existing supplies and markets. A preferable alternative might be to develop an export market for unprocessed, recovered paper. This choice may offer a better opportunity for developing supply and demand in tandem and should be a major focus of the recommended market survey.

D. OIL

Oil recycling in Alberta occurs on two main fronts: recovery of oily wastes and spills from the exploration and extraction sector, and recovery and re-refining of used lubricating oils. There is a small but active industry in Alberta that salvages oil from spills, tank bottoms, sludges and other oily waste. The salvaged oil is upgraded to pipeline-grade quality and sold to refiners for processing. This industry serves very useful functions of environmental protection, waste disposal, salvage, and resource conservation.

Used lubricating oil is recovered and re-refined through an extensive collection system. Re-refining of oil is not new in Alberta. Early recycling efforts concentrated on re-refining oil available in large quantities from major users like the railways, and returning it for their own use. However, increased environmental awareness in the late 1970s lead to the development of a system to collect oil from the small generator and to the Oil Drop program to collect oil from the individual "do-it-yourself" oil changer. The collected oil goes mainly to two re-refineries, Turbo Oil in Edmonton or Hub Oil in Calgary. Some, particularly from the Peace River area, may go to the Mohawk Oil re-refinery in Vancouver.

Some volunteer organizations use oil recycling to raise funds (31, 33, 48) and promote their collection program locally (29). These groups may have been encouraged by prices of 13 and 17 cents per litre offered for used oil in late 1985 (1, 89), but are finding that the current price provides little incentive to continue (26, 48). Indeed, Hub Oil stated that it was no longer paying for loads of less than 900 litres (1), while Turbo's price in June, 1986 was about four to five and a half cents per litre (89). The price for used oil depends on the price of crude oil, availability and quality of supply, and distance to markets. With dropping prices, some collectors are finding that collection from rural areas is no longer profitable (64) and may charge for pick-up if prices go much lower (65). Private collectors are not eligible for grants from the provincial government and this places them at a disadvantage compared to non-profit organizations (65).

Local governments and waste management authorities may encourage oil recycling because it reduces an environmental hazard by keeping oil out of the landfill (10, 31, 74) and, when prices for used oil were higher, the revenues generated more than offset the cost of collection. For example, the City of Calgary has separate settling ponds for oily wastes. Oil is skimmed from these ponds and about 90,000 to 135,000 litres per year are sold for re-refining (10). The City of Lethbridge has a 45,000-litre oil tank at its landfill and sells the recovered oil to Hub Oil (31).

Through use of these various systems, about 20 per cent of the oil sold in Alberta in 1984 was collected for re-refining (89). Hub Oil collected over 10 million litres of used oil in 1985 (1). Turbo re-refines about 13.5 million litres per year (D. Cameron 1986: pers. comm.). This level of recovery indicates Albertans' acceptance of the programs and the willingness of individuals to support oil recycling (74, 119), but the public needs more information and education about the opportunities and the benefits of oil recycling (48, 65, 120). Specific suggestions included: putting information about oil recycling centers in with the monthly utility bill, as the City of Red Deer did (44), or with tax notices (65), increased newspaper advertising, or bumper stickers (43). Others suggested actions such as tax incentives (43), a Used Oil Recycling Act (86), a per-litre subsidy (65), or an exchange of new oil for used oil brought in for recycling (43).

Expansion of used oil recycling is hampered not only by the present low value of the oil, but also by poor development of markets for the re-refined oil. Markets are holding steady, but the supply is increasing. The main markets are small-equipment operators and large industrial users who are attracted by the price savings (89). Turbo also markets its oil for use in agricultural equipment. Neither Hub nor Turbo has achieved a major breakthrough into the automotive oil markets, although the re-refined oils meet the specifications for automobile engines. To capture a significant portion of this market would require a major effort in market development. In this area, Turbo may have an advantage, being able to market its oil through its retail outlets, as Mohawk Oil does.

New markets are required for re-refined oil products. Some briefs mentioned using government procurement policies as a means of encouraging the use of recycled materials (15). The use of re-refined oil in provincial or municipal government vehicles would lend credibility to oil recycling and publicize the market potential (89). However, present provincial government procurement policies are that the oil and fuel supplied for provincial government vehicles — bulldozers to cars — are bought at the regional level with the stipulation that the successful supplier must be able to meet the requirements at the local level (S.A. Pepper 1986: pers. comm.). Only the largest oil companies have the capacity to meet these requirements.

Governments should support the use of recycled oil in recognition of the environmental benefits of recycling and avoided landfill costs. Use of recycled oil in government vehicles would help develop market acceptance in other sectors.

Recommendation:

> **Alberta Environment and Alberta Public Works, Supply and Services should work together with the used oil re-refiners to determine the market for recycled oil and to promote its use in federal, provincial, and municipal government vehicles.**

Oil re-refineries face other problems. Traditionally, re-refineries have minimized capital investment to keep operating costs low (89). With increasing restrictions on landfilling of industrial wastes, it is possible that wastes produced by the acid-clay re-refining process used in Alberta will require special treatment. This requirement could drastically increase the re-refining costs and threatens the economic viability of the re-refining facilities. In addition, Hub Oil is under increasing pressure from nearby housing developments to reduce odors from its operation or else relocate. Hub Oil is installing equipment to reduce odor emissions and also will no longer accept waste solvents and chemicals, or waste oil containing water, chemicals, solvents, anti-freeze, or detergents (1).

Without substantial capital investment and technology improvements it is doubtful that the demand for used oil will increase much beyond the present volumes. In fact, if the recovery of used oil doubled, the present facilities for re-refining in Alberta would have to be expanded (89). Therefore, significant expansion of used oil recycling will require improvements in the markets and an influx of capital to upgrade the technology and capacity of Alberta's re-refining industry.

More recent and virtually pollution-free technologies for re-refining oil are in use elsewhere in Canada. Use of these technologies in Alberta would overcome air pollution concerns and avoid most waste management problems. The provincial government must encourage the use of improved re-refining technologies if the Alberta industry is to have a future.

It is noted elsewhere in the Panel's recommendations that all plants using recycled materials should be eligible for the Accelerated Capital Cost Allowance (ACCA) for pollution control equipment on the basis of the proportion of recycled materials used. This recommendation would apply particularly to re-refineries, since they urgently need to reinvest in modern technologies and the ability to apply ACCA to their capital costs would make these investments more attractive.

If a favorable ruling on this recommendation cannot be obtained from the federal government, or if the level of assistance is not sufficient to generate the necessary level of reinvestment, the Province should act unilaterally to encourage modernization. The provincial government has taken several initiatives to assist petroleum exploration and development. The re-refining industry also is suffering from the fall in crude oil prices and, if assistance is not given, the industry could collapse. This would mean a loss of valuable jobs. It would also leave the province, municipalities, and many industries with a major problem: disposal of almost 25 million litres per year of used oil that presently is recycled. The Province should recognize the savings in environmental protection and waste management that result through re-refining used oil. These savings should be available to any company willing to establish modern, environmentally sound oil re-refining technology in Alberta.

Recommendation:

> **Alberta Environment should investigate the merits of providing a one-time capital grant to assist any company willing to develop a modern used oil re-refinery in Alberta. The levels of assistance should be comparable to those provided for such projects as heavy oil upgraders, since the principle of equality between processing used and virgin materials should apply.**

Used oil is a valuable non-renewable resource. In addition, used oil contains additives, detergents, and metals that are potentially harmful. Improper disposal of used lubricating oil through indiscriminate dumping, landfilling, and use as road oil should be discouraged.

Recommendation:

> **Alberta Environment should investigate methods for prohibiting the use of used lube oil in major road-oiling projects.**

The above recommendations, coupled with increased publicity for the Oil Drop program, should increase the volume of used oil recovered for re-refining, but re-refining technology must be improved concurrently.

E. PLASTICS

Plastics are used increasingly in wraps, packaging, containers, and various products from plant pots to ice cream sticks. Plastics are also common in appliances, automobiles, buildings, and furniture. The use of plastics may be growing at 15 to 20 percent annually (96). This increase in use will bring with it an increase in plastics in our municipal waste and a growing problem in waste management (32) unless specific steps are taken to recycle plastics.

Plastics pose problems as litter and in landfills primarily because they are not biodegradable. Although work is being done to develop biodegradable plastics (129), recycling of plastics is still a major concern (29). Recycling of plastics would reduce landfill loading (96). As well, because of the high energy value of plastics, recycling would conserve energy. Plastics may be incinerated to recover some of the energy value; however, there are concerns about the control of the hazardous gases that incineration may produce. Additional research into recycling of plastics is needed (83).

A fairly high level of recycling is achieved for industrial scrap plastics. These plastics are clean, of uniform and known composition, and usually are recycled within the company's manufacturing process. With the exception of PET (polyethylene terephthalate) beverage containers collected through the bottle depot system, little other recycling of post-consumer plastics in Alberta was brought to the Panel's attention.

The Society of the Plastics Industry of Canada is investigating the feasibility of recovering usable plastics through at-source separation by the householder. Several communities in Ontario co-operated in an attempt to recover plastics in conjunction with curbside collection of other recyclables. According to two presentors, similar efforts should be encouraged in Alberta (2, 103). Recycling of plastics may require some initial subsidies (2), such as support for at-source separation, but collection and accumulation of plastics would stimulate the development of recycling technology (2).

The availability of the large amounts of PET plastic, collected through the beverage container return system, has created interest in recycling of this material. Previously, the baled plastic bottles were sold to markets in the United States for use as fiberfill stuffing, but an Edmonton company, Applied Polymer Research, is developing technology to produce and market products including: woven and non-woven plastic fabrics, plant pots, strawberry baskets, and sheet plastics (96). There is international interest in the processes used by Applied Polymer Research and consideration is being given to licensing and exporting this technology (96).

Plastic pesticide containers represent another potential supply of large volumes of recyclable plastics, and several people at the hearings identified the use of these containers and their disposal, or, preferably, their recycling, as problems that needed to be addressed (50, 63, 64, 88, 110). Refilling and reusing the containers was also suggested (121). Studies are under way to develop methods for cleaning and reusing this source of plastic (96). The issue of recycling of pesticide containers is discussed in more detail in Section VII A.

Plastic oil containers represent another potentially large source of recyclable plastics. Disposing of these containers also is a considerable cost, especially to companies such as the quick oil change outlets and local garages. These companies would benefit from reduced disposal costs if alternative uses could be found for the plastic containers. If an economic grinding and cleaning process could be developed, the recovered plastic could be used in a variety of products. Once suitable technology is in place to handle major sources of these containers, programs could be developed to recover containers used by individuals. Any time there is a reasonable volume of plastics of similar characteristics and composition, there is an excellent opportunity for recycling.

Supplies of post-consumer plastics are available through the universal depot system, from the Pesticide Container Collection program, from commercial sources such as the rapid oil change outlets, and through curbside collection programs. Technology to collect, identify, and clean plastic containers must be developed. A high-priority area of research should be the identification and coding of plastics as to characteristics so as to improve collection and separation of post-consumer plastics. Another area that needs study is the feasibility of using single resins in all components of a container including the lid, label, and seal.

The federal or provincial government could support research and the development of technology to recover and recycle plastics, but the Panel feels that it should be the responsibility of the plastics manufacturers to ensure that their products are recyclable. The Plastics Recycling Foundation in the United States is an example of industry-supported research. The non-profit research foundation was established in 1985 to develop and improve the recycling of plastics. Its membership includes manufacturers of plastic products and resins, soft drink and packaged goods companies, and the Society of the Plastics Industry. The Foundation is funded by the members and was instrumental in the establishment of the Plastics Recycling Institute at Rutgers University, New Jersey (*Plastics Recycling Report* 1986).

A similar institute should be established in Canada with a focus on research related to the collection, separation, and recycling of post-consumer plastics. Funding for the research establishment should come from the plastics industry. In Section VII D, a checkoff against a number of products, including some plastic products, was recommended. Funds from this program would be available for research and development programs related to plastics, but it may be necessary for other funds to come directly from industries with an interest in the recycling of plastics.

Recommendation:

> **Alberta, through the Minister of the Environment, should encourage Environment Canada, in conjunction with the Society of the Plastics Industry of Canada, to establish a research institute with the objective of improving the recycling of post-consumer plastics in Canada. This research institute could be funded in part by funds collected by a checkoff on plastic products and in part by direct contributions from the plastics industry.**

F. METALS

More than 8 million tonnes of ferrous metal are recycled in Canada each year, with Alberta using about 500,000 tonnes of scrap annually (15). Recycling of metals saves energy, reduces solid waste disposal costs, conserves natural resources, increases landfill life, preserves our environment, and reduces air and water emissions associated with the extraction and smelting of virgin ore (15). There are also advantages to Alberta as a province, since we lack economically exploitable sources of metallic ore to feed metal producers. The use of scrap as the raw material for the electric arc furnaces has permitted development of a local steel industry, an industry which currently is supplying steel billets to smelters in Ontario as well as making an array of steel products for local and national use.

Unlike recycling of most other commodities in Alberta, there is very little involvement by the volunteer sector in the collection, handling, or processing of scrap metals. Scrap metal recycling is undertaken almost entirely by the private sector. The industry needs, however, participation by individuals as a source of post-consumer scrap. Individuals sell some of this scrap to scrap dealers and processors, especially auto hulks — 200,000 autos are scrapped each year in Alberta. But some of the scrap is accumulated at municipal landfill sites. Most landfill sites have special areas set aside for collecting scrap metal such as vehicle hulks, household appliances, and other discarded products (10, 19, 23, 26, 90, 110, 111). This practice is often encouraged by the local health officer as a means of facilitating safe salvage of these materials (28). When an area is full, a scrap dealer may be called in, or several dealers asked to bid on pick-up of the scrap. In more remote areas or when scrap volumes are low, the municipality may have to pay for pick-up.

The Alberta Blacksmith Society stated its concern that all scrap metal should be recovered. Many metal parts, when worn out, can be reworked by a blacksmith into useful tools and decorative pieces (85). Although this demand is small, about five tonnes are used each year in the Edmonton area, high-carbon steel being the most valuable — a blacksmith may have to pay 50 cents a kilogram for the required steel (85).

Scrap-processing companies range from local collectors equipped with a cutting torch and a pick-up truck to large, sophisticated operations using magnets, shears, shredders, and balers. To supply the Alberta steel industry, the Alberta ferrous scrap industry processes and ships about 250,000 tonnes per year to local steel mills and foundries (15). The steel companies import an additional 250,000 tonnes per year from outside of the province (15). This 500,000 tonnes is used by the two steel mills, Stelco in Edmonton and Western Canada Steel Ltd. in Calgary, and by foundries at numerous locations in the province. Of the 500,000 tonnes of ferrous scrap used annually, about 51 percent is imported or local scrap generated by steel mills, foundries, and metal refineries in the production of new metals. Eighteen percent of the scrap comes from industrial sources as scrap generated in the manufacture of metal goods. These two sources produce "prompt" scrap, so called because it rapidly enters the metal reprocessing stream. About 31 percent of the scrap used comes from discarded consumer goods, ranging from structural steel from demolished buildings to old stoves (15). This scrap is called "obsolete" scrap. Stelco estimates that its Alberta consumption is about 40 percent from discarded consumer products and 60 percent from industrial sources — metal producers and manufacturers of metal goods, supplemented with auto hulks (133).

These figures indicate the importance of collecting, processing, and reusing metals from industrial markets and post-consumer sources. This scrap is collected through a network of scrap dealers, processors, brokers, and collectors. Most major sources of scrap are tapped. For example, sources of industrial scrap usually are supplied with bins by scrap collectors for holding scrap until pick-up (133). Stelco stated that there is little uncollected obsolete scrap at any given time (133).

One brief referred to scrap metal, such as mining equipment, buried in mines in the Grande Cache area (87). It has not been economically feasible to bring this scrap, and other similar deposits, to market. While an increase in price would increase the return of obsolete scrap, some scrap that is distant from markets would not be collected without substantial incentives. Another brief suggested a public education program to inform the public about the scrap metal industry (2).

The use of drop-off bins in remote areas might result in sufficient metal being collected to justify pick-up. Adequate depots are needed to facilitate metal recycling (85). One brief suggested that there be a number of drop-off locations in each community as a means of accumulating scrap from households and small businesses (37). The collection of household metals through the curbside collection project in Edmonton will provide an idea of the availability of metallic scrap, both ferrous and non-ferrous. While the project expects to receive mainly tin food cans and aluminum beverage containers, all scrap metal is welcome.

The scrap collected in the pilot curbside collection will be sold to Stelco. Although tin in large amounts is a contaminant in most steel, it can be used in small quantities in some grades. If larger quantities of clean tin plate were available the plate could be detinned and the tin as well as the steel recovered. However, tin plate is not made in Alberta, and there is little clean scrap in the province because most of the tin cans are shipped pre-cut and ready for forming. The local steel mills accept food container scrap in recognition of the advantages of recycling and to support the "recyclability" of the tin can. In Ontario, the steel companies are paying about $70 per tonne for steel food containers to support the recycling of the steel in the face of competition from other materials, including aluminum and plastic. As well, a special two-piece, more easily recyclable steel can has been developed.

Local steel mills accept rinsed and crushed metal pesticide containers from Alberta Environment's Pesticide Container Collection Program. These containers are used as part of the raw material feed in some grades of steel. Recycling the metal containers in this manner not only destroys any pesticide residues but conserves the scrap metal.

Recycling provides the opportunity to acquire resources that are not available locally. There is a continuous movement of commodities in our "global village" and, when those commodities are discarded, the opportunity arises to obtain resources that were not available previously. A prudent industry could choose to make itself independent of insecure foreign supplies of rare metals by extracting those materials from discarded goods already available in the local marketplace. For example, rhodium, palladium, and platinum are used in catalytic convertors in cars (87). Gold, platinum, palladium, and rhodium are found in the computer boxes being used on late-model cars (87). Some specially hardened alloys contain manganese, another valuable metal, most of which is imported from South Africa.

Various types of metal-based catalysts are used in Alberta, primarily by the petroleum and petrochemical industries. Spent catalysts are considered to be a hazardous waste, but they are not yet prohibited from landfills. Because landfilling is less expensive than recycling, most companies simply landfill their spent catalysts, although a few smaller companies are environmentally responsible and have adopted "no landfill" policies (131). Subsidies are required to assist recycling of the spent catalysts. Another action that would help is for the government to encourage industries to recycle when reasonable, environmentally sound alternatives to landfilling are available (131).

Because beer and soft drinks are sold in aluminum cans in Alberta, a considerable amount of aluminum is collected through the universal depots and by Alberta Brewers' Agents. The value of the aluminum recovered through the universal depots more than pays for the cost of collection and processing, but does not cover handling charges paid to depot operators.

Recycling of aluminum is increasing (93) and in the United States more than 50 percent of aluminum products are manufactured from recycled aluminum. Recycling of aluminum provides about a 96 percent savings in energy use compared to refining bauxite ore (15). Faced with rising energy costs and competition from less expensive overseas mills, mills in the United States that depend on refining of bauxite ore are being replaced with mills using recycled aluminum.

Although there are aluminum can manufacturers in both Calgary and Edmonton, there are limited facilities for processing or using aluminum scrap. Because the use of aluminum in the beverage industry is growing, it is possible that there is now, or soon will be, sufficient scrap recovered to support an aluminum scrap processing industry. Currently this scrap proceeds through dealers in Calgary, Edmonton, or Vancouver to markets in the United States or eastern Canada (93).

Recommendation:

> **Alberta Environment and Alberta Economic Development and Trade should investigate the feasibility of further processing aluminum scrap within Alberta.**

G. RUBBER

The manufacture of tires has become much more complex since World War II, when synthetic rubbers were developed to replace some of the natural rubber components. The increase in complexity corresponded with the development of tire-manufacturing technology and the demand for high-performance tires. Today's tires last longer and perform better than the tires of yesterday. Much of this improvement is due to the newer synthetic rubbers as well as the development of steel-belted radial tires in which strands of steel replace fabric belts.

The wide range of performance features available in tires depends largely on the tire's composition. Tires may contain natural rubber and one or more synthetic rubbers, each with its own properties. Different rubbers may be used in the sidewall, carcass, tread, and inner wall. All of this is attached to a metal bead that gives the tire its shape and seals the inflated tire against the wheel rim.

As well as the natural and synthetic rubbers, other chemicals are used to bind the layers and give the tire strength, durability, and flexibility. Carbon black is a major additive, comprising between 40 and 50 percent by weight of synthetic rubber. Other additives include oil, zinc oxide, sulphur, antimony and arsenic compounds, cobolt and boron compounds, and other trace elements (Harrison and Grostern 1983).

Tire structure is changing as manufacturers respond to demands for smaller but more durable tires. With the increasing use of steel-belted tires, the amount of wire in tires has increased dramatically while the amount of rubber has declined (Table 9).

The energy value of tires ranges from 9,800 to 16,000 BTU per pound with the average weight of a discarded tire being 19.6 pounds (Harrison and Grostern 1983).

The present disposal mechanisms for discarded tires result in the tires' eventual arrival at landfills, where they are a universal problem (20, 64), since they create operational difficulties for landfill operators. Tires do not compact and take up a large volume for their weight. If tires are buried, they eventually rise to the surface of the landfill, and if they are not buried, they pose a potential fire hazard and provide habitat for mosquitoes and other vermin.

Some landfill sites have special areas set aside for storing or burying tires (10, 111), which limits the problem to a specific area of the landfill, improves management of the disposal of tires, and provides an opportunity to recover the tires if they are needed.

Albertans discard on average about one tire per person per year, or 2 million tires each year (75). Some of these tires are used by the retreading and recapping industry. These processes produce rubber buffings or rubber crumb. North West Rubber Mats Limited in British Columbia uses these buffings or crumb to make rubber mat products, including mud flaps, truck and horse trailer mats, flooring for stables and barns, and flooring for sports facilities and arenas. Products are sold across North America.

The company purchases some rubber buffings and crumb from the Calgary area (7). It also gets rubber from British Columbia and the northwestern United States. Some of the rubber crumb is bought, but, in areas where landfill disposal costs are high or there is a surcharge on the disposal of tires, the company may be paid to remove tires. The company can grind bias-ply tires after the steel bead is removed and is developing equipment to grind steel-belted tires and separate the steel fragments from the rubber shreds.

Table 9. Composition of an Average Tire

	1976 * lbs.	**1986 **** lbs.
Rubber polymer	10.1	8.0
Carbon black	6.5	4.0
Oil	3.9	4.0
Fabric	2.6	2.6
Bead	1.0	2.5
Chemicals	0.6	0.6
Zinc Oxide	0.4	0.4
Total Weight	25.1	22.1

Sources: * W.L. Wardrop and Associates Ltd. and SNC/GECO Inc. 1977.
** H. Beach 1987: pers. comm.

Even with these uses, most tires are discarded rather than recycled. Other avenues to use discarded tires have been explored, ranging from their use in fencing (108) to destructive pyrolysis for the recovery of carbon black and energy products (112). Small numbers of tires are used in playgrounds. Tires are also burned to assist brush-clearing operations (108, 111), or to thaw the ground for winter construction (110). Tires may be laid across highways to protect pavement from crossings by tracked vehicles (110). But these uses account for only a small portion of the tires discarded each year.

Experiments have been conducted using whole or shredded tires as fuel in cement kilns. Tires could be used in power plants (87). While this is a feasible option, shredded tires must be supplied at less cost than competing fuels and sufficient tires must be available to meet the ongoing fuel needs of the plant. Burning tires as a fuel is not economically feasible in Alberta considering the competing fuels available.

Considerable work has been done on the use of rubber crumb in road construction. Rubber crumb may replace part of the asphalt in the base course, pavement, or seal coat. The use of rubber crumb may improve the flexibility of the road surface, road life, and the ride, and may offer benefits in reduced ice build-up. Alberta Transportation has experimented with test road sections using rubberized seal coat, interlayers, and asphalt. However, the department has not found to date that the use of rubber in pavements has increased pavement life expectancy or provided superior performance (J. Konarzewski 1986: pers. comm.). While specialized equipment is required for the asphalt preparation, this equipment is compatible with the normal mixing process. The availability of rubber crumb may be a problem. The 10,000 tonnes of rubber crumb that could be produced from the two million tires presently estimated to be discarded each year, if used in asphalt at a three percent rate, would pave about 150 kilometres of two-lane highway.

The most significant problem, however, is the cost of collecting and processing tires into rubber crumb. Although there is interest in using rubber crumb in road construction, until it can be supplied at a cost competitive with aggregate, there is little likelihood of significant use. However, asphalt costs will increase when petroleum costs increase. If landfill costs also increase, then alternative uses for discarded tires may become more attractive. As landfill space becomes more valuable, some municipalities may impose a surcharge on the disposal of tires. These events would increase the feasibility of recycling tires.

Several briefs at the hearings discussed the problems that disposal of tires creates and the need for some use of these tires (48, 50, 75, 83). The suggestion was made that tires should be stockpiled at designated areas in the landfill until uses are found for them (103).

Recommendation:

> **Alberta Environment and Alberta Community and Occupational Health should encourage all municipalities to place discarded tires in designated areas of the landfill to facilitate future recovery and recycling.**

Until a proven and economical means for recycling tires is available, the tire manufacturing industry should bear some of the responsibility for their disposal and help to ease the costs and environmental problems incurred in disposing of the used tires. The Panel suggests that the industry and appropriate government agencies investigate ways of changing the design of tires to improve their recyclability. Funding could be achieved through checkoffs, as described in Section VII D. Improvements in the performance of tires over recent years have resulted in much longer tire life and consequent lower disposal rates for tires. The industry is to be complimented for these steps. But steel-belted radial tires pose particular problems for recycling. Although the steel belts greatly increase the safety and performance of tires, recycling is complicated by the difficult task of cutting the steel cords and separating rubber from the steel shreds. If a solution to this problem could be found, the economics of rubber recycling would be greatly improved.

IX. SUMMARY AND CONCLUSIONS

Despite numerous obstacles, recycling is carried out in Alberta by a strong volunteer and private sector. Government provides some assistance, usually in the form of small grants to volunteers and through the universal depot system created by the Beverage Container Act. Recycling recovers some resources from the waste stream, but much recyclable material continues to flow into our landfill disposal system, often to the detriment of our environment.

Waste management in Alberta presently has an ongoing public cost of at least $86 million each year. The Alberta recycling industry employs about 3,500 people and produces goods valued in excess of $300 million. This scale of industry exists despite numerous economic barriers, including subsidization of landfill disposal. In order to improve the situation for recycling, and to turn financial and environmental liabilities into assets, the Panel has developed 68 recommendations. These recommendations address the need for a level playing field for recycling relative to landfill disposal, the development of a priority sequence for dealing with waste materials (the Four R's of waste management), the requirements for information and education in many parts of the economy, the desire for equitable treatment of the recycling industry relative to other industrial sectors, and, finally, market development both through increasing supplies and stimulating demand.

Six recommendations are oriented toward providing a level playing field in the choice between waste collection with subsequent landfill disposal and materials recovery and recycling. At present there is a substantial bias in favor of landfilling through a lack of appreciation of the full costs of landfilling. In addition, subsidization of waste management systems by many municipalities means that there is no appreciation of the full costs of waste disposal and, hence, little incentive to reduce waste production. The recommendations are designed to improve the information used to make waste management decisions, and to establish procedures that encourage better, more informed decisions by municipalities and individuals.

The Four R's of waste management is a priority sequence: reduce waste production, reuse wherever possible, recycle materials that cannot be reused, and recover resources, such as energy, when the other alternatives have been exhausted. The Government of Alberta is urged to adopt the Four R's of Waste Management as its policy and priority sequence in waste management. Twenty-four recommendations deal with the Four R's, with considerable emphasis on dominant landfill components such as construction rubble, paper, and organic wastes. Several recommendations are oriented to expansion and simplification of the Beverage Container Act and increasing the valuable contributions of volunteers.

The need for information and the importance of education is brought forward in 12 recommendations. The information recommendations are intended to improve the flow of information between the supplier of waste materials and the potential user. Educational recommendations are directed toward improving waste management in educational institutions, a considerable sector of our economy, and ensuring that Albertans are knowledgeable about waste management and recycling issues. An informed public can practice good waste management at a personal level and can encourage similar behaviour by their governments.

In addition to competing with subsidized waste management systems, the recycling industry must compete with manufacturers who have preferential access to granting programs, and attractive incentives for using virgin resources. The Panel has made four recommendations that should put the recycling industries on the same economic footing as other manufacturers.

The Panel makes 22 recommendations to increase supplies of recyclable materials and encourage or determine demands. The supply side recommendations relate to: exploiting known markets, providing materials in enough quantity and of adequate quality to encourage use by manufacturers, facilitating information exchange with potential users of waste materials, and improving recyclability of commodities through research.

The demand side recommendations are largely directed toward increasing Alberta and Western Canadian demand for recycled products. However, there are important recommendations that recognize a major deficiency in Alberta recycling efforts — the lack of knowledge of the international marketplace for waste materials.

The volunteer sector plays an important role in the development of recycling, particularly when the value of the recyclable commodity is low. Recommendations to provide for government funding to the volunteer sector are made to enable volunteers to surmount the initial hurdles they face in getting started in recycling programs.

Finally, many of the recommendations referred to above recognize that waste management and recycling issues raised in the public hearings involve the federal government, and are of interest to other provinces. Common issues include: underestimation of the true cost of landfilling, discrimination in tax legislation against the recycling industry and the need to create a level playing field, and the need for design and packaging guidelines for goods marketed in Canada, aimed at reducing the environmental impacts of associated wastes. Hence, some of the recommendations, dealing with a range of topic areas, are directed toward the Government of Canada.

It is the basic belief of the Panel that if recycling is treated fairly and equitably, if it does not have to compete against subsidized waste collection and disposal services, or against industries receiving special consideration because they utilize virgin material, then recycling can expand substantially. This belief in the vitality and viability of recycling underlies this report and its recommendations. An industry that has been able to thrive to the extent that our Alberta industry has, in spite of neglect, the support to its competition, and the obstacles it has faced, has a bright future if it is treated equitably.

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PERSONAL COMMUNICATIONS

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W.C. Wordie, Accounting Manager, Western Region, Stelco Ltd., Edmonton.

APPENDIX 1.

BACKGROUND REPORTS FOR THE PUBLIC HEARINGS

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APPENDIX 2.

LOCATIONS AND DATES OF PUBLIC HEARINGS

Calgary	May 21, 22, 1986
Medicine Hat	May 27, 1986
Lethbridge	May 29, 1986
Red Deer	June 2, 3, 1986
Hanna	June 4, 1986
Olds	June 5, 1986
Camrose	June 10, 1986
Vermilion	June 12, 1986
Edmonton	June 16, 17, 1986
St. Albert	June 17, 1986
Grande Prairie	June 26, 1986

APPENDIX 3.

PARTICIPANTS AND BRIEF NUMBERS

Calgary — May 21, 1986

1	A. Shimbashi
2	William Cohen
3	John Ellacott, Foothills Conservation and Recycling Ltd.
4	Cornelius Van Huenen
5	Robert Ryan
6	Frank Linke
7	John Ellacott
8	Bob Gardner, Lomow Brothers Industries Ltd.

Calgary — May 22, 1986

9	George Breen
10	Terry Montgomery, City of Calgary
11	Julie Lockhart
12	John Ellacott
13	Rick Dvorkin
14	Carmen Simon
15	Rick Dvorkin, Calgary Metal (1985) Ltd.
16	Ray Sloan
17	Sharon Foster

Medicine Hat — May 27, 1986

18	Don Gibbons, Domglas Inc.
19	Lorne Thompson, City of Medicine Hat
20	W.G. Tuttle
21	Gordon Drybrough, Redi Enterprises
22	Rose Eresman
23	Larry Burton
24	Ann Slofstra
25	Paul Strickland

Lethbridge — May 29, 1986

26	Peter Ruppert, Village of Lomond
27	Murray MacKay, Rotary Club of Fort MacLeod

28 Kenn Blom, Barons-Eureka-Warner Health Unit
29 Julian Guay, Discussion Among Class Members
30 Paul Wilkinson
31 Walter Brodowski, City of Lethbridge
32 Alderman Hall, City of Lethbridge
33 George Tomik, Pincher Creek Elks
34 Salome Sommerfeld/Doris Boehr
35 Bill Sauve

Red Deer — June 2, 1986

36 Gary Fabris

Red Deer — June 3, 1986

37 Louise Zylla
38 Deanna Dufresne
39 Morley Kerr, Belkin Paper Stock Inc.
40 Earl Folkard, Mannville Canada Inc.
41 Robert Brant
42 William McGeachy, Rimbey Lions Club
43 Michael O'Brien
44 Mrs. Lise Mayne
45 Cliff Soper
46 Red Deer Regional Planning Commission
47 Bill Shaw

Hanna — June 4, 1986

48 Don Richardson, Hanna Young Lions Club
49 Rick Binnendyk, Town of Hanna
50 Larry King-Hunter, Big County Health Unit
51 Lavera Creasy
52 Gwen Wood
53 Norman Schmitz
54 Alberta McKinstry

Olds — June 5, 1986

55 Mary Leach, Alberta Women's Institute
56 Rita Thompson/Frank Hanlan/Ken Alif, Olds Chamber of Commerce
57 Holly Wilcox, Alberta Bottle Depot Association
58 Luigi Soprani, Warana Resources Ltd.
59 Ron Hilton, Town of Olds
60 Discussion

Camrose – June 10, 1986

61 Brian Nelson, Camrose One World Institute
62 Nelson Cochrane
63 Georgina Nelson, Camrose and County Association for Children and Adults with Learning Disabilities
64 J.R. Elliot, Alberta East Central Health Unit
65 Gordon Christensen, Alberta Used Oil Collection
66 Dale Bowal, Centra-Cam Industries
67 Ted Matson
68 Terry Fleenor, ATF Construction
69 Gary Gibeault, Camrose Regional Solid Waste Authority

Vermilion – June 12, 1986

70 Doug MacLennan/Jack McKoen, Village of Ryley (Rural Development Project No. 4)
71 Jean Sloan
72 Frank Wheat
73 George Zaychkowsky, Lloydminster Sheltered Workshop
74 Cliff Magnusson, Town of Vermilion
75 Discussion

Edmonton – June 16, 1986

76 John Gill, Millwoods Anti-Dump Action Committee
77 Lynda Paterson, Oldman River Regional Planning Commission
78 Bill Flook, Urban Environment Study Group, Public Advisory Committees to the Environment Council of Alberta
79 Alvin Ballachay, Allied Paper Savers
80 Karen Vander Meulen, Citizens for Public Justice
81 William (Bill) Flook
82 John Priestly, Fiberglas Canada Inc.
83 Bob Carlyle
84 John Sworder, J.E. Sworder Engineering Ltd.
85 Gerry Paschen, Alberta Blacksmith Society
86 Jill Flett, Environmental Law Centre
87 Discussion

Edmonton – June 17, 1986

88 John Kolkman/Al DeBoer, Christian Farmers Federation of Alberta
89 Doug Normandin, Turbo Resources Ltd.
90 Ed Podivinsky, City of Edmonton

91 Ralph Haeckel, Urban Reform Group of Edmonton
92 Stuart Belkin, Belkin Paper Stock Inc.
93 Jocelyn Gagne, Alcan Rolled Products Co.
94 Albert Liem
95 Brian Thompson, Outdoors Unlittered
96 Carl Surrendi, Applied Polymer Research Ltd.
97 Sally Issenman, Sundance Recycling
98 Peter Schneider, Strathcona Engineering Ltd.
99 Tooker Gomberg
100 Har Sabharwal, World University and Other Organizations

St. Albert — June 17, 1986

101 Ross Hammond
102 Larry Loven, Voltec Industry
103 Cheryl Miciak
104 Discussion

Grande Prairie — June 26, 1986

105 Geoff Sawyer/Mary Jackson, Valleyview Regional Economic Development Board
106 Ted Blowers, Valleyview and District Association for the Handicapped
107 Larry Medd
108 Ed Piebiak, Alberta Transportation
109 John Barnard, Grande Prairie Economic Development Commission
110 Discussion
111 Discussion

Supplementary Briefs

112 Hugh Christiansen
113 Richard Kuhn, Energy Study Group, Public Advisory Committees to the Environment Council of Alberta
114 Eva Wong
115 Kenn Blom, Barons-Eureka-Warner Health Unit
116 Herman Dorin
117 Mrs. M. Hepher
118 Wally Heinrichs, Pembina Institute for Appropriate Development
119 Ivan Whitson
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121 C. Redvers Perry
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124 Frank Hanlan
125 Jim Shipka

126	P. Irene Edgar
127	Alvin Ballachay, Allied Paper Savers
128	Jocelyn Gagne, Alcan Rolled Products Co.
129	H.J. de Jongh
130	John Runge, Cosmos Enterprises
131	L.S. Feldman, Catalyst Disposal Services (Canada) Ltd.
132	Guenter Hauber
133	Stelco
134	G. Mark

APPENDIX 4.

MEETINGS WITH DEPARTMENTS, AGENCIES, AND ORGANIZATIONS

Federal Government

Energy, Mines and Resources
Environment
Regional Industrial Expansion

Provincial Government

Alberta Environmental Centre
Alberta Government Telephones
Alberta Liquor Control Board
Alberta Research Council
Alberta Special Waste Management Corporation
Community and Occupational Health
Economic Development and Trade
Education
Energy
Energy Resources Conservation Board
Environment
Forestry, Lands and Wildlife
Hazardous Chemical Act Advisory Committee
Municipal Affairs
Public Works, Supply and Services
Social Services
Technology, Research and Telecommunications
Transportation and Utilities

Municipal Government

Edmonton Telephones

Non-Government Organizations

Alberta Brewers' Agents Ltd.
Alberta Soft Drink Association
Contain-A-Way

N.L.C. - B.N.C.
3 3286 07222165 4